THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

BULLETIN No. 91-7

DATA ON WATER WELLS AND SPRINGS IN THE CHUCKWALLA VALLEY AREA

RIVERSIDE COUNTY, CALIFORNIA

Prepared by
UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

FEDERAL-STATE COOPERATIVE GROUND WATER INVESTIGATIONS

MAY 1963

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State of California
THE RESOURCES AGENCY OF CALIFORNIA
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This report is one of a series of open file reports prepared by the United States Department of Interior Geological Survey, Ground Water Branch, which presents basic data on wells obtained from reconnaissance surveys of desert areas. These investigations are conducted by the Geological Survey under a cooperative agreement whereby funds are furnished equally by the United States and the State of California. The reports in this Bulletin No. 91 series are being published by the Department of Water Resources in order to make sufficient copies available for use of all interested agencies and the public at large. Earlier reports of this series are:

Bulletin No. 91-1
Data on Wells in the West Part of the Middle Mojave Valley Area,
San Bernardino County, California

Bulletin No. 91-2
Data on Water Wells and Springs in the Yucca Valley-Twentynine Palms Area,
San Bernardino and Riverside Counties, California

Bulletin No. 91-3
Data on Water Wells in the Eastern Part of the Middle Mojave Valley Area,
San Bernardino County, California

Bulletin No. 91-4
Data on Water Wells in the Willow Springs, Gloster, and Chaffee Areas,
Kern County, California

Bulletin No. 91-5
Data on Water Wells in the Dale Valley Area, San Bernardino and
Riverside Counties, California

Bulletin No. 91-6
Data on Wells in the Edwards Air Force Base Area, California

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division
Ground Water Branch
Sacramento 14, California

November 27, 1962

Mr. William E. Warne, Director
California Department of Water Resources
P. O. Box 388
Sacramento 2, California

Dear Mr. Warne:

We are pleased to transmit herewith, for publication by the Department of Water Resources, the U. S. Geological Survey report, "Data on Water Wells and Springs in the Chuckwalla Valley Area, Riverside County, California," by F. W. Giessner.

This report, one of a series for the Mojave Desert region, was prepared by the Long Beach subdistrict office of the Geological Survey in accordance with the cooperative agreement between the State of California and the Geological Survey. The report tabulates all available data on wells and springs in Chuckwalla Valley, and shows reconnaissance geology with special reference to the water-yielding deposits.

Sincerely yours,

Fred Kunkel

Fred Kunkel
District Geologist

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DATA ON WATER WELLS AND SPRINGS IN THE CHUCKWALLA VALLEY AREA, RIVERSIDE COUNTY, CALIFORNIA

By F. W. Giessner

PURPOSE AND SCOPE OF THE STUDY

The desert areas of southern California, of which the Chuckwalla Valley area is a part (fig. 1), are broad valleys or basins that have been partly filled by alluvial deposits and are surrounded by nearly barren mountain ranges. These basins contain ground water that varies widely in chemical quality and is potentially available for development for irrigation, industrial, and domestic supply.

The objective of the investigation was the collection and tabulation of all available hydrologic data for use in planning orderly development and utilization of the ground-water resources, as well as providing a basis for subsequent detailed ground-water studies.

Fieldwork by the U.S. Geological Survey in the area included: (1) A very brief reconnaissance of the major geologic features to define the extent and general character of the deposits that contain ground water; (2) an inventory and examination of virtually all the water wells in the area to determine and record their locations in relation to geographic and cultural features and the public-land net, and to record the depths and sizes of the wells, the types and capacities of installed pumping equipment, uses of the water, and other pertinent information; (3) the measurement and recording of the depth to the water surface in wells, below established and described measuring points at or near the land surface; (4) the selection of representative wells and the periodic measurements of water level in these wells in order to detect changes of water levels; and (5) the collection and compilation of well records, including well logs, water-level measurements, and chemical analyses.

This study has been made by the U.S. Department of the Interior, Geological Survey, as a part of the cooperative program with the California Department of Water Resources to investigate the ground-water resources of the desert areas. Fieldwork and preparation of the report have been under the general supervision of H. D. Wilson, Jr., and Fred Kunkel, successively district engineer and district geologist in charge of ground-water investigations in California, and under the immediate supervision of G. M. Hogenson, geologist in charge of the Long Beach subdistrict office.

LOCATION AND GENERAL FEATURES OF THE AREA

The Chuckwalla Valley area, as described in this report (fig. 1), includes about 1,160 square miles. The area of this study lies in the desert region of southern California between long 114°46' and 115°45' W. and lat 33°28' and 34°02' N. The boundaries are shown on figures 1, 2, and 3.

The area includes all or parts of the following U.S. Geological Survey and Army Map Service topographic quadrangle maps at a scale of 1:62,500: Cadiz Valley, Canyon Spring, Chuckwalla Mountains, Chuckwalla Spring, Coxcomb Mountain, Iron Mountains, McCoy Spring, Midland, Palen Mountains, Palo Verde Mountains, and Sidewinder Well. (See index maps of figs. 2 and 3.)

Access to the area is provided by U.S. Highway 60-70 and the Parker Dam Highway.

The Chuckwalla Valley is a desert area of internal drainage with no perennial streams. It consists of a broad alluviated valley bounded on the south by the Orocopia Mountains, Chuckwalla Mountains, Little Chuckwalla Mountains, and Mule Mountains. It is bounded on the west by the Eagle Mountains and on the east by the Mule Mountains and McCoy Mountains. Several northerly trending mountain ranges, the Coxcomb Mountains, Granite Mountains, Palen Mountains, and Little Maria Mountains, bound the valley to the north and extend into the valley. The intervening valleys are contiguous with and tributary to the main part of Chuckwalla Valley.

GEOLOGIC AND HYDROLOGIC FEATURES

The geologic units in the Chuckwalla Valley area can be grouped into two broad categories: consolidated rocks and unconsolidated deposits.

The consolidated rocks include the metamorphic and igneous intrusive rocks of pre-Tertiary age that form the basement complex. In some localities, the consolidated rocks include volcanic rocks of Tertiary age that overlie the basement complex. For the most part, the consolidated rocks are not water bearing, except for minor amounts of water contained in cracks and residuum.

The unconsolidated deposits consist of sedimentary material that was deposited in a continental environment, mainly during Quaternary time. Some of the sedimentary rocks may be as old as late Tertiary. Most of the material was waterlain as alluvial-fan, stream-channel, lake or playa deposits, but some of the sand was deposited by wind. Included in the unconsolidated deposits are the Pinto Formation of Scharf (1935, p. 11-20), older alluvium, lacustrine deposits, and fan deposits, all of Pleistocene age, and younger alluvium, playa deposits, and windblown sand, all of Recent age.

The lacustrine deposits of Pleistocene age are shown on figures 2 and 3 and consist mainly of bentonitic clay interbedded with very fine sand and silt. The deposits are flat lying, moderately indurated, and appear to be locally gypsiferous with numerous sandy oblong concretions present in the clay. The extent of dissection varies with the location. The exposures northwest of Palen Lake consist mainly of mesa-type prominences varying in height from 5 to 10 feet. In this locality the deposits are capped with a surface of caliche and support scattered areas of mesquite. The deposits overlain by the alluvial fans extending south from the Palen Mountains are believed to be more extensive than is shown on figure 2. If the alluvial fans were dissected to greater depths, the lacustrine deposits would be exposed over a greater lateral area. The lacustrine deposits are differentiated from the overlying alluvial fans by the absence of coarse fragmental material and the presence of thick beds of pinkish clay. These deposits would probably yield only small amounts of water to wells.

Scharf's Pinto Formation, of Pleistocene age, is shown on figure 3. This formation consists mainly of coarse bouldery fanglomerate and lacustrine clay, with some interbedded basalt. The fanglomerate deposit probably would yield water freely to wells, but the basalt probably would yield only small amounts of water.

The older alluvium is of Pleistocene age and is shown on figure 2. It consists of fine to coarse sand interbedded with gravel, silt, and clay. The color of the deposit ranges from dark brown to red, with a speckled appearance caused by numerous small white nodules of caliche. The deposit apparently is extensive, but surface exposures are limited to a few gravel pits where the overlying deposits of younger alluvium and windblown sand have been removed. The older alluvium yields water freely to wells and probably is the most important aquifer in the area.

The fan deposits of Pleistocene age, which are shown on figures 2 and 3, are poorly sorted and consist of boulders, very coarse to fine gravel, sand, silt, and clay. The fans are characterized by local areas of well-developed desert pavement. This deposit is generally above the water table and is not considered a water-bearing unit. Where saturated, the fan deposits may yield small amounts of water to wells.

The younger alluvium of Recent age, which is shown on figures 2 and 3, is poorly sorted and consists of gravel, sand, silt, and clay. This permeable deposit overlies many of the geologic units in Chuckwalla Valley as a thin veneer and is believed to be mostly above the water table. If saturated, this deposit probably would yield water freely to wells.

The playa deposits of Recent age, which are shown on figures 2 and 3, consist mainly of clay, silt, and sand. These deposits occur in three locations: Ford Lake, Hayfield Reservoir, and Palen Lake. Of the three playas, Palen Lake is probably the only playa which discharges ground water by evapotranspiration. The playa deposits are relatively impermeable and probably will not yield water readily to wells.

The belt of windblown sand of Recent age, which is shown on figures 2 and 3, consists of actively drifting sand and is a result of easterly and westerly winds. This unit mainly occupies the lower elevations of the valley from the northwest end of Chuckwalla Valley to the eastern limit of the mapped area. The deposit varies in thickness from 0 to 25 feet. Some of the dunes are anchored by vegetation. This deposit apparently is above the water table and is not considered to be a water-bearing unit.

In many of the desert valleys of southern California, the unconsolidated water-bearing alluvial deposits underlying the valley floors are displaced along faults, which impede the horizontal movement of ground water. Such faults may be present in Chuckwalla Valley, but, if so, they are not apparent on aerial photographs or to field inspection. Also, pronounced differences in water levels within short horizontal distances, which suggest faulting of the water-bearing deposits, are not known to be present.

The ground-water supply in Chuckwalla Valley is replenished by ground-water inflow from Pinto Basin and by runoff from the slopes of the mountains surrounding the valley. Also, a small amount of recharge may originate from infrequent rain on the valley floor.

Ninety-two wells and springs were inventoried in the Chuckwalla Valley area. Data for these wells are listed in tables 1 through 4, and the well locations are shown on figures 2 and 3. Measured water levels range from 485 feet below land surface in well 5/14-36A1, west of Desert Center, to 21 feet below land surface in well 4/17-6C1, north of Palen Lake. Examination of all water levels in the valley indicates a ground-water gradient from the Desert Center area eastward toward the gap between the Mule Mountains and McCoy Mountains. The gradient is steeper in the western half of the valley and is nearly flat in the eastern part.

Five wells have been selected as representative to show the range of long-term water-level fluctuations in different parts of the area. Complete published and unpublished records for wells 4/16-32D1, 4/17-6C1, and 5/16-8K1 are shown in table 2. Records for wells 4/16-29R1 and 7/20-4R1 are shown in table 1.

PREVIOUS WORK AND ACKNOWLEDGMENTS

Data on ground water and geology in Chuckwalla Valley are contained in reports by the Geological Survey (Brown, 1920, p. 45-67, and 1923, p. 101-106, 236-251, 261-264, 272-273, 276, 280-283; Kunkel, 1956, pl. 1); California Department of Public Works (1954, p. 40-41, 59; 1956, p. 9-10, 33-34, 51-56); California Department of Water Resources (1958, p. F-3; 1960, p. F-2; 1961, p. D-2); Hoppin (1954, pl. 1); and Scharf (1935, p. 11-20).

The author expresses appreciation for the cooperation given by ranchers, well owners, well drillers, and other persons who furnished information for this investigation. The California Department of Water Resources and the Riverside County Flood Control District provided all the pertinent information in their files, including well logs, water-level records, and chemical analyses. The cooperation and assistance given by these people and agencies contributed materially to the preparation of this report and are gratefully acknowledged.

WELL-NUMBERING SYSTEM

The well-numbering system used in the area described in this report has been used by the Geological Survey in California since 1940. It has been adopted by the California Department of Water Resources and by the California Water Pollution Control Board for use throughout the state.

Wells are assigned numbers according to their location in the rectangular system for the subdivision of public land. For example, in the number 5/16-7M1 the part of the number preceding the slash (/) indicates the township (T. 5 S.); the number following the slash indicates the range (R. 16 E.); the number following the hyphen (-) indicates the section (sec. 7); the letter following the section number indicates the 40-acre subdivision of the section as shown in the diagram below:

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Within the 40-acre subdivision, the wells are numbered serially as indicated by the final digit. Thus, well 5/16-7M1 is the first well to be listed in the NW$\frac{1}{4}$SW$\frac{1}{4}$ sec. 7.

For well numbers where a _Z_ has been substituted for the letter designating the 40-acre subdivision, the _Z_ indicates that the well is plotted from unverified location descriptions. The indicated sites of such wells were visited but no evidence of a well could be found.

Because the Chuckwalla Valley area is situated entirely within the southeast quadrant of the San Bernardino base and meridian, the township and range designations, as given, are adequate.

In those instances where wells have been found to be located inaccurately and a number has been assigned previously, they have been correctly plotted on the map but the original numbers have been retained. This has been done to avoid the necessity for number changes in reports already published. Fortunately, these mislocated wells are few in number and were seldom misplaced any farther than one of the adjoining 40-acre subdivisions.

Springs are numbered according to the same system as wells, except that the letter _s_ has been substituted for the final digit in the number.

REFERENCES CITED

Brown, J. S., 1920, Routes to desert watering places in the Salton Sea region, California: U.S. Geol. Survey Water-Supply Paper 490-A, 86 p., 7 pls., 2 figs.

____________1923, The Salton Sea region, California: U.S. Geol. Survey Water-Supply Paper 497, 283 p., 19 pls., 18 figs.

California Department of Public Works, Division of Water Resources, 1954, Ground water occurrence and quality, Colorado River basin region: Water Quality Inv. Rept. no. 4, 59 p., 9 tables, 11 pls.

____________1956, Office report on water well and ground water data in Pahrump, Mesquite, Ivanpah, Lanfair, Fenner, Chuckwalla, and Jacumba Valleys: Mimeo rept., 58 p., 3 tables, 5 pls.

California Department of Water Resources, 1958, Water supply conditions in southern California during 1956-57: Bull. 39-57, v. 3, 650 p., app. D, E, F, G, H, pls. E-1, F-1, G-1, H-1.

____________1960, Water supply conditions in southern California during 1957-58: Bull. 39-58, v. 3, 348 p., app. D, E, F, G, H, pls. E-1, F-1, G-1, H-1.

____________1961, Water supply conditions in southern California during 1958-59: Bull. 39-59, v. 3, 296 p., app. C, D, E, F, pls. C-1, D-1, E-1, F-1.

Hoppin, R. A., 1954, Geology of the Palen Mountains gypsum deposit, Riverside County, California: California Dept. Nat. Resources, Div. Mines Spec. Rept. 36, 25 p., 1 pl., 32 figs.

Kunkel, Fred, 1956, A brief hydrologic and geologic reconnaissance of Pinto Basin, Joshua Tree National Monument, Riverside County, California: U.S. Geol. Survey open-file rept., 35 p., 5 pls., 6 tables.

Scharf, David, 1935, The Quaternary history of the Pinto Basin in Campbell, E. W. C., and Campbell, W. H., The Pinto Basin site: Highland Park, Calif., Southwest Museum Papers no. 9, 51 p., 14 pls.

Table 1.--Data on water wells and springs in the Chuckwalla Valley area, California

USGS number: The number given is the Geological Survey number assigned to the well or spring according to the system described in the text.

Source of data and other numbers: The source of the data and observations on each line is indicated by the following symbols: CE California Electric Power Co.; CVP Coachella Valley Pump and Supply, Inc.; DWR State of California, Department of Water Resources; GS Geological Survey, or reported by owners, drillers, or others; MWD Metropolitan Water District of Southern California; and WSP U.S. Geological Survey Water-Supply Papers 497 (1923) and(or) 490-A (1920) by J. S. Brown; where no symbol is given, the source of data is the same as indicated on the preceding line. Numbers following the letter symbols DWR and MWD indicate the number of that well as used by that agency.

Date of observation: Data for each well are presented in reverse chronological order, with the most recent information summarized on the top line, opposite the well number.

Owner or user: The name given is that of the owner or user of the well or spring on the date indicated. In some instances, the local name of the well or spring is given.

Year completed: The year the well was completed was obtained from the driller's log or reported by the owner or others.

Depth: Depths given in feet and tenths were measured below land-surface datum by the Geological Survey; depths given in whole feet were reported by owners, drillers, or others.

Type of well and diameter: The type of well construction is indicated by the following symbols: C cable tool, D dug, R rotary. G indicates the well is gravel packed. The number following the letter is the diameter of the casing or pit, in inches.

Pump type and power: The type of pump and(or) method of lift is indicated by the following symbols: L lift, N none, S submersible, T turbine. The type of power is indicated as follows: D diesel engine, G gasoline engine, H hand-operated, N none, W windmill; a number in this column indicates electric power and gives the rated horsepower of the motor.

Yield: The yield or output of the pump, in gallons per minute, is usually based on tests performed by the California Electric Power Co., Ray Roberts Pump and Equipment, Coachella Valley Pump and Supply, Inc., or is reported by the well owners or drillers. It is not necessarily the maximum capacity of the well or the installed pump.

Specific capacity: The specific capacity of a well is its rate of yield per unit of drawdown of the water level in the well. It is determined by dividing the figure in the Yield column by the drawdown resulting from sustained pumping at that rate; the result is expressed in terms of gallons per minute per foot of drawdown.

Use: Dm domestic, Ds destroyed or dry, In industrial, Ir irrigation, Ps public supply, S stock, T test hole, and Un unused.

Measuring point: The point from which water-level measurements by the Geological Survey are made is described as follows: Bhc bottom of hole in casing, Bpb bottom of pump base, Hpb hole in pump base, Ls land surface, Na no access, Tap top of access pipe, Tc top of casing, Tcc top of casing cover. The suffix letters N, S, E, W, indicate the side--north, south, east, or west-- from which the measurement is made. The distance of the measuring point above land-surface datum is given in feet and tenths and sometimes hundredths. All measurements of water level are from the same measuring point, unless otherwise indicated; however, not all of the measuring points used by others are known.

Altitude: The figure given indicates the altitude, in feet above mean sea level, of the land-surface datum at the well site. This plane of reference is approximately at ground surface. Altitudes were interpolated from Geological Survey topographic maps.

Water level: Measured depths to water level are given in feet, tenths, and sometimes hundredths; reported or approximate depths to water are given in whole feet. The water-level measurements are below land-surface datum. For these measurements, the difference in altitude between land-surface datum and the measuring point has been subtracted from the measured water level.

Other data: C chemical analysis of water given in table 4, E electric log of well in files of Geological Survey, L driller's log of well given in table 3, P pumping test records in files of Geological Survey, W measurements of water level given in table 2.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Specific capacity	Well data: Use	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 2 S., R. 17 E.											
2/17-30E1	MWD-10	1-30-33	Metropolitan Water District	1933	624	6½		7		T		850	325	L,P
			T. 3 S., R. 18 E.											
3/18- 3Q1	GS	6-14-61	Packer Well		17.0	D 60	N N			Un	TccN 2.0	1,675	13.24	C
	DWR-11X1	?			15	48								
		5-21-52								Dm			11	
22	WSP-497	11- 2-17			28								18	
11A1	GS	6-14-61	Adams Well	1900	39.7	D 24	N N			Un	TcW 0	1,580	37.35	C
	WSP-490A	1918			43								20	
	WSP-497	11- 2-17			43								20	
			T. 4 S., R. 15 E.											
4/15-13C1	GS	8- 2-61	Metropolitan Water District	1932	452	16	T N			Un	Tcc .5	683	183.73	L,P
	MWD-7	4-21-61											183.65	
		2-12-32						450					132	
			T. 4 S., R. 16 E.											
4/16-19M1	GS	6-10-61	Zwang, Harris, Baker	1961	585	RG 16	N N			Un	TcW 1.0	610	126.89	
		4-21-61											127.28	

19N1	GS	4-21-61			151.2		e6	N	N			Un	Ls	0	600	a111.6	
21N1	GS	4-22-61			38.7		12	N	N			Ds			565		
29R1	GS	10- 6-61 9-16-61 4-22-61			109.7		12	N	N			Un	Tc Tc	1.76 4.0	545	79.93 80.00 79.95	C
30D1	GS CE	6-10-61 5-17-61 10-25-60	Zwang, Harris, Lyttle		610	RG	16	T	D	 5075	 110	Ir	Tc	1.0	603	a114.30 113.91 120.0	C,P
31D1	CE GS	6-15-61 5-17-61	John Penfield	1961	600	RG	15	T	100	2328	44	Ir	BpbS	.5	595	95.0 95.65	C,L,P
31R1	GS WSP-497	4-22-61 1917-18	Boulder Well	1907	35.6 80		6	N	N			Ds			555	 60	
32D1	GS	10- 6-61	Walter Palladine	1953	610	RG	14	N	N	2750	80	Un	Tc	1.0	555	g78.45	C,E,L,P,W
32E1	GS	4-22-61	U.S. Government		77.0		10	N	N			Ds			555		
32M1	GS	6-14-61 6-10-61 4-21-61 4-10-61	Walter Palladine	1958	555	R	14	T	75	2000		Ir	BhcW	1.0	555	a73.46 71.43 71.61 71.41	C,L
35Z1	WSP-497	1917	Palen Well									Ds			470	12-14	

See footnotes at end of table.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Sp. cap.	Use	Measuring point	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 4 S., R. 17 E.												
4/17- 6C1	GS	4-10-61	Harold Stark	1932	501	16	T G	106		Dm	TcE	0	500	21.82	C,L,P,W
	DWR-3/17-31X1	5-21-52												21	
	MWD-9	1-15-32												22.5	
			T. 5 S., R. 12 E.												
5/12-28Es	GS	5-21-61	U.S. Government										2,825	Flowing	
			T. 5 S., R. 13 E.												
5/13-23H1	GS	4-26-61	U.S. Government		f70.0						Ls	0	1,850	Dry	
			T. 5 S., R. 14 E.												
5/14-24R1	MWD-6	1-31-33	Metropolitan Water District	19[illegible]	733	$6\frac{1}{2}$				T			1,072	570	L
35L1	GS	11- 9-61	Bordon Hillman	1958	600	C 8	N N	2		Un	Tc	0	1,270	570	
35L2	GS	11- 9-61	Bordon Hillman	1961	641	C 8	N N	6		Un	Tc	0	1,270	571	
36A1	GS	4- 9-61	Paul Campbell	1958	377	RG 10	N N			Un	Tc	1.0	1,190	485.43	E

T. 5 S., R. 15 E.

5/15- 1E1	GS	6-10-61	C. N. Beard		755	RG	16	T	30			Ir	TcS	1.5	645	145.84	
		4-21-61														144.57	
1L1	GS	6-10-61	Franna Farms	1960	790	RG	16	T	D			Ir	TcS	.5	640	138.51	C,L,P
		4-21-61														136.90	
	CE	3-30-61								1674	42					140.0	
		3-21-60								3150						b214.0	
2E1	GS	6-10-61	F. P. Gribbin	1960	728	RG	16	T	60			Ir	Tap	1.0	700	209.82	E,P
		4-21-61														193.54	
		11-29-60								3300	56					206	
12N1	GS	5-18-61	Frank Kanne	1961	746	RG	16	T	75	1900		Ir	Na		688		C,L
		4-28-61						N	N			Un	Tc	1.0		173.07	
13B1	GS	9-18-61	Franna Farms	1959	788	RG	16	T	D			Ir	TcS	1.0	650	159.9	C,E,L, P,W
	CE	10-20-60								1872						b302.0	
		3-25-60								2295	15					158.0	
		10-12-59								1855	13					163.0	
14E1	GS	6-11-61	C. L. Reese	1960	799	RG	16	T	D			Ir	EhcS	.5	750	244.53	E,P
		4-21-61														d244.2	
	Owner	11-29-60								1200	15					255	
14J1	GS	6-17-61			62.9			N	N			Ds			710		
15E1	GS	6-11-61	C. L. Reese	1960	808	RG	16	T	D	2000	33	Ir	HpbS	1.0	805	313.40	E,P
		4-21-61														313.17	
23N1	GS	3-28-61	Stanley Ragsdale	1951	409	C	6	T	10			Ps	Na		880	367	C
27B1	GS	6-10-61	California Division Highways	1954	644	C	10	T	15			Dm	TapN	1.0	900	395.14	C,L
		3-28-61														395.30	
	DWR-27C1	5-10-58														394.6	
		7- ?-54														410	

See footnotes at end of table.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Sp. cap.	Use	Measuring point	(feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 5 S., R. 15 E.--Continued												
5/15-27B2	GS	6-10-61	Stephen Ragsdale	1925		8	N N			Ds			900	(c)	
27H1	GS	3-28-61	Stephen Ragsdale	1951	598	R 12	T 30			Ps	Bpb	0	904	d428.6	C
	DWR	2-17-51												366	
29F1	GS	4- 9-61	D. Hancock		680	6	S 5			Ps	Tcc	1.0	1,046	b374	C
		9- 5-58												388.3	
		5-31-56												372.3	
			T. 5 S., R. 16 E.												
5/16- 5B1	GS	4- 7-61	C. W. Carney	1948	114	6	L 1			Dm	Tc	1.21	560	70.93	C,W
	DWR 4/16-31X1														
5B2	GS	6-10-61	R. E. Anderson	1960	715	RG 14	T 60			Ir	BhcS	1.0	548	68.59	C,L,P,W
	CE	4- 3-61						1589	84					b92.0	
		10-17-60						1667	76					b81.0	
		6-27-60						3926	81					74.5	
5E1	GS	4- 9-61	C. W. Carney	1948	124	8	T N			Un	Na		570		
6N1	GS	8- 6-61	A. E. Peterson	1960	723	RG 16	T 60	3850	71	Ir	Bhc	.5	604	126.41	C,E,L, P,W
	CE	4- 5-61						1273	65					b143.0	
		10-17-60						3604						b211.4	
7M1	GS	8- 6-61	H. C. Brown	1958	648	RG 14	T 60			Ir	BhcE	.5	614	126.93	C,P,W
	CE	6-15-61						1118	124					b144.0	
		4- 5-61						1115						b144.0	
		4-20-59						767						b134.0	
		2-17-59						1324	94					b135.0	
		2-21-58						3634	110					b147.0	

7M2	GS CE	9- 7-61 2-16-59	H. C. Brown	1959	789	RG	14	N	N	 3082	 37	Un	TcN	1.0	611	126.15 b233.8	C,E,L, P,W
7P1	GS DWR-7N1	4-25-61	Southern Counties Gas Co.	1952	347	RG	10	S	10			In	Tap	2.39	608	a121.30	C,L,W
8F1	GS Driller DWR-8G1 DWR-8X1	4- 9-61 8----42	Desert Center Airport	1942	206		14	T	G	 125	 2	Dm	Na		560	 83	C,L,P
8K1	GS	8- 6-61	Desert Center Airport	1942	212		14	N	N	180	9	Un	Bhc	2.0	555	83.04	L,P,W
9E1	GS	6-19-61	Corona Well				6	N	N			Ds			545		
10Z1	GS WSP-497	6-18-61 12-17-18	Gruendike Well		 76.4	 D		N L	N W			Ds S				 74	 C
18M1	GS CE	4-21-61 6-27-60	H. C. Brown	1960	790	RG	15	T	D	 3203	 160	Ir	BhcW	1.5	646	160.56 155.0	C,P
18Q1	GS	6-18-61			36.6	D	60	N	N			Ds			660		
22N1	GS	9-12-61 6-15-61			515.7		6	N	N			Un	Tc	.5	653	g188.19 188.22	C
25F1	GS	5-16-61	John Harmon	1956	680	RG	14	T	D	1200		Ir	BhcE	0	598	134.58	C,W
36N1	GS Owner	6- 9-61 6- 3-55	Charles Carr	1955	357	RG	6	T	G			Dm	BpbN	1.0	730	274.14 295	C,L
			T. 5 S., R. 17 E.														
5/17-19Q1	GS Owner	4-20-61 4- 6-61 6- ?-58	H. G. Tacke	1958	760	RG	14	T	D	1600		Ir	Rpb	0	535	76.17 76.18 105	L,P

See footnotes at end of table.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Sp. cap.	Use	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 5 S., R. 17 E.--Continued											
5/17-20F1	GS	4- 6-61	Sidewinder Well		10	10	N N			Ds		465	(c)	C
	DWR	5-10-58			95								41.2	
		5-16-57											45.0	
21Z1	WSP-497	1917								Ds			98	
29E1	GS	4-20-61	Edna A. Tacke	1958	983	RG 14	T D			Ir	BpbN 0	533	84.28	L,P
		4- 6-61											84.24	
	CVP	7- ?-60						1250					106	
29H1	GS	4- 8-61	Lloyd Loveland	1958	1025	R	N N			T		495		L
30F1	GS	4-20-61	John Harmon	1958	720	RG 16	T D			Ir	BhcE .5	570	108.35	C,L
		4- 6-61											108.37	
	Owner	8-29-58											120	
30P1	GS	4- 6-61	Noble Well	1937	147.2	6	N N			Ds		620		C
	DWR	5-10-58											Dry	
		5-16-57			152								150	
33N1	GS	4-20-61	Lloyd Loveland	1958	758	RG 14	N N			Un	Tc 1.0	597	172.59	C,L
		4- 7-61											172.69	
	Owner	5-28-58											179	

			T. 5 S., R. 20 E.											
5/20-16Ms	GS DWR-17	5-19-61	McCoy Spring							Un		889	Flowing	C
			T. 6 S., R. 12 E.											
6/12-10K1	GS Driller	4-26-61 1-18-32		1932	 450		12	N	N	Un	Na	1,747	 Dry	L
			T. 6 S., R. 15 E.											
6/15- 2Hs	GS	6-12-61	Long Tank										Flowing	
5B1	GS WSP-490A	3-28-61 1917	Granite Mine Well		38.0 41	D	60	N	N	Ds		1,400	Dry 22.5	
29 24E1	GS	8- 4-61	W. C. Seidel		22	D	48	L	G	Dm	Na	1,995	18	C
24E2	GS	8- 4-61	Stanley Strong		25	D	48	L	G	Dm	Na	2,000	18-20	
24E3	GS DWR-24X1	4-27-61	Aztec Well		14	D		L	H	Dm	Na	1,995		C
24E4	GS	4-27-61	Juan de la Garcia		13	D		L	W	Dm	Na	1,995		
24L1	GS	8- 4-61	Chauncey Squire		10	D	36	L	G	Dm	Na	1,950	7	
24M1	GS	8- 4-61	George Barley			D		L	G	Dm		2,000	Sump	
24M2	GS	8- 4-61	George Barley		16	D		L	G	Dm	Na	2,000		
30Q1	GS DWR-7/15- 4X1	8- 1-61	Red Cloud Mine		14.8	D	36	N	N	Un	TecN O	2,200	12.38	C

See footnotes at end of table.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Sp. cap.	Use	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 6 S., R. 16 E.											
6/16-28D1	GS DWR-20	4-27-61	Corn Spring		14.0	D	N N			Ds		1,548	Dry	C
			T. 6 S., R. 17 E.											
6/17- 3M1	GS Owner	4-20-61 4- 7-61 6- ?-58	C. W. Budd	1958	818	C 12	T D			Ir	TapE 0.5	565	189.98 189.85 150	C,L
			T. 6 S., R. 19 E.											
6/19-19J1	GS	7-24-61				12	N N			Un	TcE 1.0	354	60.05	
25P1	GS	9-20-61			85.7	10	N N			Un	Tc 1.0	360	80.95	C
25R1	GS	9-20-61			61.9	10	N N			Ds		360		
26Z1	WSP-497	1917								Ds			70	
30H1	GS	7-25-61			28.7	6	N N			Ds		370		
31Z1	WSP-497	1917								Ds			109	
33A1	GS WSP-497 DWR-33X1	4- 6-61 10-17-17	Hopkins Well	1911	63.2 1200	8	N N			Ds		358	 70.8	C,L

36A1	GS	9-20-61			64.8		10	N	N			Ds			365		
			T. 6 S., R. 20 E.														
6/20-30Z1	GS WSP-497	4- 5-61 10-17-17	Ford Well				10	L	W			Ds S				489	C
			T. 6 S., R. 21 E.														
6/21-31M1	GS	4- 5-61	C. V. Bratcher		450.4		6	N	N			Un	Tc	.5	500	241.56	
			T. 7 S., R. 18 E.														
7/18-11N1	GS	10-10-61 6-19-61			486.4		16	N	N			Un	Tc	0	555	258.83 259.64	C
[illegible] 11R1	GS	10-10-61 6-19-61			779.4		16	N	N			Un	Tc	1.0	520	221.65 221.65	C
14H1	GS	10-10-61			123.9		6	N	N			Ds			546		
			T. 7 S., R. 19 E.														
7/19- 4R1	GS	10-10-61 4- 6-61	Teaque Well		242.2		12	N	N			Un	Tc	.5	423	143.18 143.09	C
			T. 7 S., R. 20 E.														
7/20- 4R1	GS	10-10-61 6-12-61	Vada McBride		315.7	C	16	N	N			Un	Tc	0	418	151.09 151.83	C
18H1	GS	4- 5-61	Vada McBride	1959	1139	R	14	T	D	1000	11	Ir	TapW	1.0	445	168.37	C,L
27L1	GS	8- 5-61			53.6		8	N	N			Ds			517		

See footnotes at end of table.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Sp. cap.	Well data: Use	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 8 S., R. 17 E.											
8/17-16Ks	GS	6-17-61	Chuckwalla Spring							Un		1,760	Flowing	
			T. 8 S., R. 20 E.											
8/20-10N1	GS	9-15-61	Wiley Well	1908	37.8	D 47	N N			Un	Tcc 2.0	585	31.43	C
		3-21-61											29.75	
	DWR-8X1	5-22-52											25	
	WSP-497	11- 7-17			45	36							37	

a. Nearby well being pumped.
b. Well being pumped.
c. Obstruction in well.
d. Tape smeared.
e. Uncased hole.
f. Inclined mine shaft.
g. Water-level recorder installed.

Table 2.--Measurements of the water level in wells

This table includes all unpublished records for wells having five or more water-level measurements; records for wells having less than five measurements are shown in table 1.

Altitudes given are in feet above mean sea level for the land-surface datum at the well. Land-surface datum is a plane of reference which approximates land surface. Altitudes were interpolated from U.S. Geological Survey topographic maps.

All measurements of water level are in feet below land-surface datum. That is, the altitudes of the measuring points as reported above land-surface datum have been subtracted from the water-level measurements.

4/16-32D1. Walter Palladine. Depth about 610 ft. Altitude about 555 ft. Measurements by California Department of Water Resources, except as indicated.

Date	Water level	Date	Water level	Date	Water level
May 15, 1953	109	May 10, 1958	67.8	Apr. 21, 1961	a76.98
Sept. 17, 1954	65.5	May 18, 1959	f74.9	May 16	78.1
May 25, 1955	66.0	Sept. 11	76.7	17	a78.26
Oct. 2	66.1	May 18, 1960	79.1	June 10	a77.80
May 16, 1957	67.7			Oct. 6	a h78.45

4/17-6C1. Harold Stark. Depth about 501 ft. Altitude about 500 ft. Measurements by California Department of Water Resources, except as indicated.

Jan. 15, 1932	b22.5	May 25, 1955	21.2	Sept. 11, 1959	21.9
May 21, 1952	21	Oct. 16, 1956	21.4	Apr. 10, 1961	a21.82
Sept. 17, 1954	21.2	May 16, 1957	21.6		

See footnotes at end of table.

5/15-13B1. Franna Farms. Depth about 788 ft. Altitude about 650 ft. Measurements by U.S. Geological Survey, except as indicated.

Date	Water level	Date	Water level	Date	Water level
Oct. 12, 1959	c163.0	Apr. 20, 1961	157.73	May 18, 1961	157.43
Mar. 25, 1960	c158.0	25	f164.95	June 10	f164.94
Oct. 20	c g302.0	27	158.15	19	e158.0
		May 17	158.45	Sept. 18	159.9

5/16-5B1. C. W. Carney. Depth about 114 ft. Altitude about 560 ft. Measurements by California Department of Water Resources, except as indicated.

May 25, 1955	71.1	May 16, 1957	72.7	May 18, 1959	72.0
Oct. 2	71.0	May 10, 1958	71.2	May 18, 1960	71.5
May 31, 1956	72.7	Sept. 5	71.0	Apr. 7, 1961	a70.93
Oct. 16	71.5				

5/16-5B2. R. E. Anderson. Depth about 715 ft. Altitude about 543 ft. Measurements by California Electric Power Co., except as indicated.

June 27, 1960	74.5	Apr. 3, 1961	g92.0	June 10, 1961	a68.59
Oct. 17	g81.0	9	a70.69		

5/16-6N1. A. E. Peterson. Depth about 723 ft. Altitude about 604 ft. Measurements by U.S. Geological Survey, except as indicated.

Oct. 17, 1960	cg211.4	May 20, 1961	f126.49	June 19, 1961	128.43
Apr. 5, 1961	cg143.0	June 9	f124.99	Aug. 6	126.41
9	123.78	10	124.39		
25	123.05	14	128.43		

5/16-7M1. H. C. Brown. Depth about 648 ft. Altitude about 614 ft. Measurements by U.S. Geological Survey, except as indicated.

Feb. 21, 1958	cg147.0	Apr. 9, 1961	121.14	June 14, 1961	125.52
Feb. 17, 1959	cg135.0	20	125.61	15	cg144.0
Apr. 20	cg134.0	June 10	125.12	19	129.19
May 18, 1960	i120.9	11	126.84	Aug. 6	126.93
Apr. 5, 1961	cg144.0	13	127.20		

See footnotes at end of table.

5/16-7M2. H. C. Brown. Depth about 789 ft. Altitude about 611 ft. Measurements by U.S. Geological Survey, except as indicated.

Date	Water level	Date	Water level	Date	Water level
Feb. 16, 1959	cg233.8	May 17, 1961	126.25	June 15, 1961	127.34
Apr. 22, 1961	126.03	18	127.13	20	f129.27
25	f125.67	20	f128.37	July 24	126.36
May 16	h127.00	June 10	125.70	Aug. 6	126.02
				Sept. 7	126.15

5/16-7P1. Southern Counties Gas Co. Depth about 347 ft. Altitude about 608 ft. Measurements by Southern Counties Gas Co., except as indicated.

Sept. 12, 1952	d108	Oct. 1956	105	June 1959	f116
Mar. 1954	105	Nov.	105	July	105
Apr.	105	Dec.	105	Aug.	f116
May	105	Jan. 1957	105	Sept.	105
June	105	Feb.	105	Oct.	105
July	104	Mar.	105	Nov.	f113
Aug.	105	Apr.	105	Dec.	105
Sept.	105	May	105	Jan. 1960	105
Oct.	105	June	105	Feb.	105
Nov.	105	July	105	Mar.	g122
Dec.	105	Aug.	105	May 18	i111.8
Jan. 1955	105	Sept.	105	May	g122
Feb.	105	Oct.	105	June	g124
Mar.	105	Nov.	105	July	g121
Apr.	105	Dec.	105	Aug.	g124
May	104	Jan. 1958	105	Sept.	g128
June	105	Feb.	105	Oct.	121
July	105	Mar.	105	Nov.	122
Aug.	105	Apr.	105	Dec.	122
Sept.	105	May	105	Jan. 1961	122
Oct.	104	June	f119	Feb.	116
Nov.	104	July	115	Mar.	117
Dec.	104	Aug.	113	Apr. 25	a f121.30
Jan. 1956	104	Sept.	f119	Apr.	117
Feb.	104	Oct.	105	June	128
Mar.	105	Nov.	105	July	133
Apr.	105	Dec.	105	Aug.	127
May	105	Jan. 1959	f108	Oct. 7	a122.71
June	105	Feb.	g121	8	a122.25
July	105	Mar.	105	9	a122.59
Aug.	105	Apr.	f121		
Sept.	105	May	105		

See footnotes at end of table.

5/16-8K1. Desert Center Airport. Depth about 212 ft. Altitude about 555 ft. Measurements by California Department of Water Resources, except as indicated.

Date	Water level	Date	Water level	Date	Water level
Aug. 15, 1942	d85	May. 16, 1957	84.2	Apr. 9, 1961	a83.01
May 25, 1955	84.3	May 10, 1958	83.9	20	a83.03
Oct. 2	84.2	Sept. 5	84.0	May 16	83.8
May 31, 1956	84.2	May 18, 1959	83.5	June 10	a83.03
Oct. 16	84.2	May 19, 1960	83.2	Aug. 6	a83.04

5/16-25F1. John Harmon. Depth about 680 ft. Altitude about 598 ft. Measurements by the California Department of Water Resources, except as indicated.

May 31, 1956	132	Sept. 5, 1958	138.5	Apr. 7, 1961	a134.52
Oct. 16	130.5	May 18, 1959	134.1	May 16	a134.58
May 16, 1957	136.7	May 18, 1960	139.8		

a. Measurement by U.S. Geological Survey.

b. Measurement by the Metropolitan Water District of Southern California.

c. Measurement by California Electric Power Co.

d. Measurement from driller's log.

e. Tape smeared.

f. Nearby well being pumped.

g. Well being pumped.

h. Water-level recorder installed.

i. Measurement by California Department of Water Resources.

Table 3.--Drillers' logs of wells

2/17-30E1. The Metropolitan Water District of Southern California. Altitude about 850 ft. Drilled by Metropolitan Water District in 1933. $6\frac{1}{2}$-inch uncased test hole. Bailer-tested 7 gpm with no drawdown.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand and gravel -----	90	90	Shale, blue ----------	43	488
Sand and gravel, hard streaks -----------	85	175	Sand and blue shale --	62	550
Sand and gravel, hard and soft streaks --	99	274	"Lime Shell" ---------	2	552
Sand and gravel -----	36	310	Sand and gravel, very soft----------------	18	570
Clay, red -----------	45	355	Clay, red, sticky ----	8	578
Clay, blue ----------	90	445	Shale, blue ----------	45.8	623.8

4/15-13C1. The Metropolitan Water District of Southern California. Altitude about 683 ft. Drilled by Metropolitan Water District in 1932. 16-inch casing, perforated 220-248 and 317-328 ft. Yield 450 gpm.

Sand and rock -------	6	6	Sand and gravel ------	39	254
Sand, cemented ------	23	29	Sand, "heaving" ------	58	312
Clay and gravel -----	15	44	Sand and gravel ------	12	324
Gravel --------------	5	49	Sand, "heaving" ------	16	340
Sand, cemented ------	137	186	Sand and clay --------	91	431
Sand, fine ----------	29	215	Clay, red ------------	21	452

4/16-31D1. John Penfield. Altitude about 595 ft. Drilled in 1961. 15-inch casing. Yield 2,328 gpm with 52 ft drawdown.

No record --	300	300
Sand, fine to very coarse, quartz predominating, subrounded, dark fragments (volcanics?) increasing with depth, occasionally interbedded with silt ------------------------	20	320
Sand, fine to coarse, interbedded with light-tan silt --------	20	340
Sand and gravel, coarse to fine ----------------------------	20	360
Sand, fine to very coarse, interbedded with silt, increasing with depth --	60	420
Sand and gravel, very coarse to fine, quartz predominating, interbedded with light-gray-tan silt ----------------------	100	520
Sand, fine to coarse ---	20	540
Silt and clay, interbedded with medium to coarse sand --------	20	560
Sand, very coarse, interbedded with silt --------------------	20	580
Sand, fine to medium ---	20	600

4/16-32D1. Walter Palladine. Altitude about 555 ft. Drilled by James E. Wright, Jr., in 1953. 14-inch casing, perforated 137-597 ft. Yield 2,750 gpm with 34 ft drawdown. Well drilled to 733 ft, backfilled and cased to 610 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface material ----	5	5	Clay, brown, fine sand layers ------	129	373
Sand and gravel; layers	45	50	Gravel, coarse, and boulders ---------	222	595
Sand, coarse, gravel	5	55	Gravel, coarse -----	80	675
Boulders, small -----	10	65	Bedrock ------------	58	733
Sand, coarse; gravel; layers ------------	64	129			
Clay ----------------	115	244			

4/16-32M1. Walter Palladine. Altitude about 555 ft. Drilled by Vanderpool Drilling Co. in 1958. 14-inch casing to 255 ft, 12-inch casing 255 to 555 ft, perforated 265-555 ft. Yield 2,000 gpm.

Sand, fine ----------	40	40	Sand, coarse, with clay -------------	180	350
Sand ----------------	40	80	Sand, extra coarse	118	468
Sand, coarse --------	30	110	Gravel, small, in clay -------------	87	555
Clay, sandy ---------	60	170			

4/17-6C1. Harold Stark. Altitude about 500 ft. Drilled by the Metropolitan Water District of Southern California in 1932. 16-inch casing, perforated 63-95 and 245-252 ft. Bailer-tested 106 gpm with no drawdown.

Clay and gravel -----	17	17	Gravel -------------	9	88
Clay, yellow, hard --	14	31	Clay and gravel ----	19	107
Clay and gravel -----	5	36	Clay, brown, hard, sticky -----------	138	245
Clay, brown, hard ----	11	47	Clay and gravel ----	7	252
Clay and gravel -----	15	62	Clay, brown, hard, sticky -----------	249	501
Clay ----------------	1	63			
Gravel --------------	13	76			
Clay and gravel -----	3	79			

5/14-24R1. The Metropolitan Water District of Southern California. Altitude about 1,072 ft. Drilled by Metropolitan Water District in 1933. 6½-inch uncased hole.

	Thickness (feet)	Depth (feet)
Sand; gravel and boulders	344	344
Boulders	46	390
Sand; gravel and boulders	159	549
Boulders or "ledge"	3	552
Sand; gravel; boulders	16	568
Boulders, cemented	27	595
Sand, hard; gravel	13	608
Sand; gravel; small boulders	27	635
Gravel, water-bearing	15	650
Gravel, cemented; boulders	7	657
Sand, brown; gravel	3	660
Sand; gravel and boulders	8	668
Sand, cemented; gravel	6	674
Gravel and boulders	3	677
Gravel, cemented; boulders	52.9	729.9
Boulders	2.9	732.8

5/15-1L1. Franna Farms. Altitude about 640 ft. Drilled by F. R. Squire in 1960. 16-inch casing, perforated 348.75-784.05 ft. Yield 3,150 gpm with 74 ft drawdown after 30 hours.

Topsoil; clay and silt	20	20
Gravel, small; hard sand	49	69
Sand, hard; rock	46	115
Clay and sand, "broken"	44	159
Sand, very fine; gravel, small; clay, "broken"	181	340
Sand, coarse; gravel, small to medium; clay, "broken"	340	680
Sand, coarse; gravel, small to medium	104	784
Clay	5.9	789.9

5/15-12N1. Frank Kanne. Altitude about 688 ft. Drilled in 1961. 16-inch casing, perforated 526-746 ft. Yield 1,900 gpm.

No record	150	150
Sand, fine to coarse, quartz and feldspar predominating	25	175
Sand, medium, angular	25	200
Sand, fine to very coarse, subrounded, quartz and feldspar predominating, few dark fragments; small amount of silt	100	300
Sand, fine to very coarse; clay	25	325
Gravel, fine; sand, medium to coarse, some very dark fragments; clay	75	400
Clay, light-gray, interbedded with fine to medium sand	25	425

5/15-12N1.--Continued.

	Thickness (feet)	Depth (feet)
Gravel, medium to coarse, subrounded, dark fragments increasing; interbedded occasionally with clay	25	450
Sand, very coarse, and medium gravel, interbedded with clay	50	500
Sand, very fine to coarse, quartz predominating, some dark fragments (volcanics?)	75	575
Sand, very fine, ran, interbedded with clay	25	600
Sand, fine to coarse, quartz predominating	45	645
Sand, fine to coarse, interbedded with gray clay	45	690
Clay, occasionally interbedded with medium to coarse sand	15	705
Sand, fine to medium, occasional fragments 1/8- to 1/4-inch diameter	25	730
Clay, light-gray	16	746

5/15-13B1. Franna Farms. Altitude about 650 ft. Drilled by F. R. Squire in 1959. 16-inch casing to 350 ft, 12-inch casing to 788 ft, perforated 215-788 ft. Yield approximately 3,200 gpm with 190 ft of drawdown after 10 hours of pumping.

Sand, fine; small gravel	120	120
Sand, fine; clay; broken formation with both	180	300
Sand, fine; small gravel; clay	50	350
Sand, coarse; gravel; clay; broken formation	438	788

5/15-27B1. California Division of Highways. Altitude about 900 ft. Drilled by Henderson and sons in 1954. 10-inch casing to 637 ft, perforated 553-625 ft.

Gravel; sand, silty	389	389
Gravel; sand, silty, with some broken rock	3	392
Loam, sandy; some pea gravel	17	409
Loam, black, sandy; small amount stagnant water	20	429
Loam; sand, coarse, angular; small amount water	124	553
Sand, coarse, silty, with some gravel up to 3/4 inch, increasing amount of water	14	567
Loam, sandy; sufficient water for drilling	10	577
Sand, coarse, silty; gravel up to 3/4 inch; alternate layers 6 to 8 ft	48	625
Sand, coarse, conglomeratic, "tight," with silty clay matrix	19	644

5/16-5B2. R. E. Anderson. Altitude about 548 ft. Drilled by owner in 1960. 14-inch casing to 305 ft, 12-inch casing 305 to 705 ft, perforated 224-705 ft. Yield 3,926 gpm with 48.5 ft drawdown.

	Thickness (feet)	Depth (feet)
Surface soil; sand; gravel	110	110
Clay, sandy; streaks of sand and cobbles	110	220
Clay, brown	45	265
Sand, coarse; gravel	45	310
Clay, brown	30	340
Clay, sandy	20	360
Sand, coarse	75	435
Gravel	35	470
Sand, coarse; gravel; streaks of cobblestone	245	715

5/16-6N1. A. E. Peterson. Altitude about 604 ft. Drilled by Armstrong and Fowler in 1960. 16-inch casing to 334 ft, 12-3/4 inch casing 334 to 722 ft, perforated 228-331 and 334-722 ft. Casing hung 1 ft off bottom. Yield 3,850 gpm with 54 ft drawdown.

Surface sand, clay and cobbles	120	120
Sand, fine, with streaks of clay	90	210
Sand, medium to coarse, with thin streaks of light-brown clay	150	360
Sand, fine; silt	50	410
Sand, medium to coarse, with streaks of clay	130	540
Sand, coarse, with streaks of conglomerate	183	723

5/16-7M2. H. C. Brown. Altitude about 611 ft. Drilled by owner in 1959. 14-inch casing to 300 ft, 12-inch casing 300 to 789 ft, perforated 280-789 ft. Yield 3,082 gpm with 83.1 ft drawdown.

Surface sand, clay streaks and gravel	90	90
Sand, buff to light-brown, fine to medium, quartzitic	115	205
Clay with streaks of fine to medium sand	75	280
Clay, buff to tan, with silty streaks	40	320
Sand, light-brown, medium to coarse, quartzitic, subangular, with streaks of clay at base	85	405
Clay, light-brown, with streaks of silt and fine sand	70	475
Sand, buff to tan, medium to coarse, with hard places in streaks, some basalt fragments noted	90	565
Sand, buff, coarse, with streaks of silty clay	105	670
Sand, light-tan to brown, cobbles in streaks, coarse, quartzitic, basalt and greenstone fragments noted, very high porosity and permeabilities	119	789

5/16-7P1. Southern Counties Gas Co. Altitude about 608 ft. Drilled by James E. Wright, Jr., in 1952. 10-inch casing to 296 ft, 8-inch 296 to 347 ft, perforated 248-296 and 299-347 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface soil --------	5	5	Rock, large ---------	5	302
Sand and gravel, cemented ----------	155	160	Rock and gravel with clay streaks -------	15	317
Clay ----------------	100	260	Rock; gravel --------	30	347
Gravel and clay in layers ------------	11	271			
Rock; gravel --------	26	297			

5/16-8F1. Desert Center Airport. Altitude about 560 ft. Drilled by Roscoe Moss Co. in 1942. 14-inch casing to 206 ft, perforated 103-168 and 172-188 ft. Yield 125 gpm with 62 ft drawdown.

Sand, coarse --------	82	82	Clay; gravel to 1 inch	12	168
Clay, sandy ---------	21	103	Sand, packed; clay ---	8	176
Sand; gravel to 1 inch	15	118	Sand, coarse ---------	12	188
Clay, sandy ----------	38	156	Clay, sandy ----------	18	206

5/16-8K1. Desert Center Airport. Altitude about 555 ft. Drilled by Roscoe Moss Co. in 1942. 14-inch casing to 212 ft, perforated 103-124, 162-178, and 180-198 ft. Yield 180 gpm with 20 ft drawdown.

Sand, coarse --------	84	84	Sand; clay -----------	16	176
Clay ----------------	19	103	Clay, sandy ----------	4	180
Sand; gravel to $1\frac{1}{2}$ inches ------------	21	124	Sand; gravel to $1\frac{1}{2}$ inches -------------	14	194
Clay, sandy ---------	36	160	Clay, with soft streaks	18	212

5/16-36M1. Charles Carr. Altitude about 730 ft. Drilled by James E. Wright, Jr., in 1955. 6-inch casing to 357 ft, perforated 261-357 ft.

Rock and sand -------	34	34	"Granite rock" -------	6	257
Pea gravel ----------	3	37	Clay; sand; rock -----	23	280
Sand, tight; rock ---	4	41	Gravel, hard packed --	6	286
Sand, loose ---------	11	52	Sand, coarse; gravel	11	297
Gravel, light; rock	5	57	Gravel, coarse -------	11	308
Sand, medium; gravel	18	75	Clay; sand -----------	8	316
Clay ----------------	98	173	Clay, hard -----------	6	322
Rock; gravel --------	24	197	Sand; gravel ---------	9	331
Sand and rock; clay	37	234	Sand, tight ----------	12	343
Clay ----------------	17	251	Clay -----------------	14	357

5/17-19Q1. H. G. Tacke. Altitude about 535 ft. Drilled by Coachella Valley Pump and Supply, Inc., in 1958. 14-inch casing to 302 ft, 12-inch casing 302 to 758 ft, perforated 314-758 ft. Yield 1,600 gpm.

	Thickness (feet)	Depth (feet)
Surface sand and gravel ------------	123	123
Clay and gravel, mixed	46	169
Sand; gravel --------	9	178
Clay; gravel --------	94	272
Sand, fine ----------	4	276
Clay ----------------	52	328
Gravel --------------	8	336
Clay ----------------	4	340
Sand; gravel with light clay streaks	223	563
Clay; gravel streaks	127	690
Clay, with fine sand	50	740
Clay ----------------	20	760

5/17-29E1. Edna A. Tacke. Altitude about 533 ft. Drilled by Coachella Vallev Pump and Supply, Inc., in 1958. 14-inch casing to 307 ft, 12-inch casing 307 to 981 ft, perforated 103-295 and 321-981 ft. Yield 1,250 gpm.

Surface sand and gravel------------	95	95
Clay ----------------	43	138
Sand and gravel -----	19	157
Clay ----------------	13	170
Sand and gravel -----	11	181
Clay ----------------	33	214
Sand and gravel, with clay -------------	16	230
Clay ----------------	11	241
Sand and gravel -----	9	250
Clay and shale, with sandy streaks -----	41	291
Shale ---------------	119	410
Clay, with sand-stone caps ------	50	460
Sand; gravel; shale in streaks ------	211	671
Shale; sand; gravel	89	760
Shale with light streaks; sand ---	77	837
Sand, fine; shale	34	871
Shale, with streaks of fine sand and gravel ----------	59	930
Sand, fine; gravel	8	938
Shale -------------	12	950
Sand, fine; gravel	13	963
Sand; gravel; shale	20	983

5/17-29H1. Lloyd Loveland. Altitude about 495 ft. Drilled by Coachella Valley Pump and Supply, Inc., in 1958. Uncased test hole.

Surface sand and gravel ------------	96	96
Clay ----------------	49	145
Sand, with streaks of clay -----------	54	199
Clay ----------------	112	311
Clay, with streaks of sand -----------	215	526
Clay, with light streaks of gravel and sand ----------	54	580
Clay, with streaks of sand; gravel; shale ------------	148	728
Shale --------------	132	860
Shale, with streaks of sand and small gravel ----------	165	1,025

5/17-30F1. John Harmon. Altitude about 570 ft. Drilled by Coachella Valley Pump and Supply, Inc., in 1958. 16-inch casing to 306 ft, 12-inch casing 306 to 698 ft, perforated 120-288 and 314-698 ft.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, fine to coarse	35	35	Gravel --------------	11	435
Sand, coarse; gravel	75	110	Clay ----------------	8	443
Sand, medium -------	32	142	Gravel --------------	5	448
Sand, coarse -------	37	179	Clay ----------------	58	506
Clay ---------------	56	235	Gravel --------------	8	514
Clay; some rock ----	15	250	Clay ----------------	78	592
Clay ---------------	10	260	Gravel; rock --------	21	613
Rock, rough --------	34	294	Clay ----------------	23	636
Rock; clay streaks -	26	320	Gravel; rock --------	8	644
Clay, sticky -------	18	338	Clay ----------------	18	662
Clay ---------------	22	360	Gravel --------------	9	671
Clay; some rock ----	22	382	Shale; fine sand ----	19	690
Clay ---------------	42	424	Sand, coarse --------	30	720

5/17-33N1. Lloyd Loveland. Altitude about 597 ft. Drilled by Coachella Valley Pump and Supply, Inc., in 1958. 14-inch casing to 254 ft, 12-inch casing 254 to 758 ft, perforated 266-758 ft.

Surface sand -------	102	102	Clay streaks; sand --	340	556
Clay; sand; gravel	18	120	Sand streaks; "sand-stone cappings"-----	202	758
Clay ---------------	88	208			
Sand; gravel -------	8	216			

6/12-10K1. Altitude about 1,747 ft. Drilled by Lyon Brothers Well Contractors in 1932. 12-inch casing. Well dry.

Sand, gray, packed	158	158	"Decomposed granite"	10	340
Sand, cemented; clay	82	240	Clay, brown, hard ---	20	360
"Decomposed granite"	80	320	"Decomposed granite"	90	450
Clay, yellow --------	10	330			

6/17-3M1. C. W. Budd. Altitude about 565 ft. Drilled by J. B. Baker in 1958. 12-inch casing, perforated 165-680 ft.

	Thickness (feet)	Depth (feet)
Alluvial fill	48	48
Clay, sandy; gravel	9.5	57.5
Clay, brown	18.5	76
Shale, tan	49	125
Shale, blue-gray	11	136
Clay, brown (water at 165 ft)	32	168
Clay, tan, sandy	7	175
Clay, tan	23	198
"Hard sandstone ledge"	6	204
Clay, sandy	26	230
Clay, brown	31	261
Shale, hard	14	275
Clay, tan; "hard ledges"	123	398
Clay, tan, sandy	21	419
Sandstone, hard	31	450
Sandstone, young	5	455
Sand, gray, loose	14	469
Clay, gray; sandy streaks	62	531
Clay, sticky	23	554
Shale, brown, hard	144	698
"Chenle" shale	33	731
Shale, brown	78	809
Clay, sticky	9	818

6/19-33A1. Hopkins Well. Altitude about 358 ft. Drilled in 1911. 8-inch casing, perforated 1,175-1,200 ft. Log from U.S. Geological Survey Water-Supply Paper 497, p. 242.

Soil, probably fine sand and silt	60	60
Clay	40	100
Alternate sand and clay	500	600
Sand, sandrock, and gravel	300	900
Not given; presumably sand and gravel	275	1,175
Water-bearing gravel; good water	25	1,200
Bedrock, probably schist or granite		

7/20-18H1. Vada McBride. Altitude about 445 ft. Drilled by Moffitt and Wells in 1959. 14-inch casing to 343 ft, 12-inch casing 343 to 1,083 ft, perforated 853-1,083 ft. Yield 1,000 gpm with 90 ft drawdown.

	Thickness (feet)	Depth (feet)
Sand, coarse; gravel	54	54
Clay	29	83
Sand, fine; clay	12	95
Sand and gravel	6	101
Clay	6	107
Sand, fine, with clay streaks	7	114
Sand and gravel, with clay streaks	6	120
Sand, fine, with clay streaks	40	160
Clay, with fine sand streaks	27	187
Sand, fine	8	195
Clay, sticky	40	235
Rocks	1	236
Clay	23	259
Sand, fine, cemented	5	264
Sand, fine to medium	31	295
Clay	10	305
Sand, fine to coarse	4	309
Sand, fine, cemented	7	316
/Material/, fine to coarse, mixed with clay streaks	36	352
Sand, gray, streaks	11	363
Sand, fine, tight	11	374
Clay, brown	26	400
Sand, fine	10	410
Clay; shale	15	425
Sand, fine, free	3	428
Sandstone, tight	2	430
Clay, brown, with sand streaks	6	436
Clay, brown	5	441
Sand, fine, with gravel	9	450
Clay	2	452
Pebbles, fine to medium	16	468
Sand, fine to medium, free	4	472
Clay	9	481
Sand and clay, tight	4	485
Sand, fine; gravel, with clay streaks	6	491
Sand, fine, with clay streaks	10	501
Sand, fine, with gravel and clay streaks	9	510
Gravel, fine to medium	20	530
Clay, streaks	5	535
Gravel, fine to medium, with clay streaks	23	558
Clay, brown	2	560
Sandstone	3	563
Clay, brown	12	575
Sand; clay	8	583
Sand, fine to medium; clay	27	610
Sand; clay	2	612
/Material/, fine to coarse	35	647

7/20-18H1.--Continued.

	Thickness (feet)	Depth (feet)
Gravel, fine to medium	10	657
Sand, fine, with clay streaks	22	679
Sand, fine; gravel with clay	21	700
Clay	4	704
Sand, fine; gravel with clay streaks	17	721
Sand, fine, cemented, with clay streaks	23	744
Sand, fine; gravel	10	754
Rocks, rough, hard	3	757
Sand, fine, with clay streaks	6	763
Rock, rough	1	764
Shale, white and brown; clay	9	773
Sand, fine to coarse	21	794
Clay; fine sand	9	803
Clay, blue	2	805
Shale, hard	1	806
[Material], fine to coarse	6	812
Sand, fine; clay	20	832
Sand, fine to medium, tight	10	842
Sandstone, gray, fine; shale	7	849
Clay; shale	11	860
Clay, blue	3	863
Sandstone	1	864
Sand, fine; gravel with clay streaks	10	874
Sand, fine	11	885
[Material], fine to coarse, with clay streaks	9	894
Shale; gravel; lime	9	903
Sand, fine; gravel with sandstone streaks	24	927
Sandstone, hard, free	3	930
Sand, fine; gravel	23	953
Sand, fine; coarse gravel; sandstone in streaks	22	975
Sand, fine; coarse gravel	14	989
Sand, rough, mixed with gravel	8	997
[Material], fine to medium; coarse gravel	23	1,020
Sand, fine; gravel	10	1,030
Sand, fine, with clay streaks	33	1,063
Gravel with clay streaks	38	1,101
Sand, fine to coarse	18	1,119
Sand, tight, cemented	2	1,121
[Material], fine to coarse	6	1,127
Clay	2	1,129
Sand, fine to coarse, free	8	1,137
Sand, cemented	2	1,139

Table 4.--Chemical analyses of water from wells

The calculated values of dissolved solids were computed from the sum of determined constituents by the Ground Water Branch, U. S. Geological Survey. Values for sodium preceded by the letter a indicate a combination of sodium and potassium. Values preceded by the letter b were calculated by the Ground Water Branch. Values preceded by the letter c indicate a combination of calcium and magnesium.

The analyzing laboratory is indicated by the following symbols: CL Coast Laboratories, Fresno, Calif.; DWR State of California, Department of Water Resources; H Hornkohl Laboratories, Inc., Bakersfield, Calif.; R U.S. Department of Agriculture, Salinity Laboratory, Riverside, Calif.; SPH State of California, Department of Public Health; UC University of California.

Well number	3/18-3Q1		3/18-11A1	
Date of collection	5-21-52	11-2-17[1/]	9-16-61[2/]	11-2-17[1/]
Results in parts per million				
Silica (SiO_2)		74	40	57
Iron (Fe)		.37		2.4
Calcium (Ca)	51	352	585	53
Magnesium (Mg)	8	42	208	13
Sodium (Na)	216	a408	6,720	a178
Potassium (K)			86	
Bicarbonate (HCO_3)	342	293	1,480	331
Carbonate (CO_3)		0	0	0
Sulfate (SO_4)	66	170	1,110	203
Chloride (Cl)	202	1,070	2,780	63
Fluoride (F)			2.9	
Nitrate (NO_3)	1.8	4.6	25	Trace
Boron (B)	.33		20	
Dissolved solids				
Calculated	713	2,260	12,300	732
Residue on evaporation at 180°C	757	2,380	22,500	758
Hardness as $CaCO_3$	160	1,050	2,320	186
Noncarbonate hardness as $CaCO_3$			1,100	
Percent sodium	74		86	
Specific conductance (micromhos at 25°C)	1,230		22,000	
pH	8.1		7.2	
Temperature (°F)				
Depth of well (feet)	17.0	17.0	39.7	43
Analyzing laboratory	DWR		DWR	
Laboratory number	2413		R4183	

See footnotes at end of table.

Well number	4/16-29R1		4/16-30D1	
Date of collection	10-5-61[2]	10-5-61[6]	8-3-61	10-25-60
Results in parts per million				
Silica (SiO_2)	18	4	22	
Iron (Fe)				
Calcium (Ca)	13	0	17	
Magnesium (Mg)	0	1	1	
Sodium (Na)	237	274	179	172
Potassium (K)	4.3	4.3	2.7	
Bicarbonate (HCO_3)	186	290	82	76
Carbonate (CO_3)	0	18	0	4
Sulfate (SO_4)	197	165	219	
Chloride (Cl)	110	110	90	87
Fluoride (F)	6.9	4.4	3.6	
Nitrate (NO_3)	14	5.6	9.3	
Boron (B)	.82	1.2	.56	.68
Dissolved solids				
Calculated	693	730	584	481
Residue on evaporation at 180°C	671	778	554	580
Hardness as $CaCO_3$	33	3	45	
Noncarbonate hardness as $CaCO_3$	0	0	0	
Percent sodium	93	99	89	
Specific conductance (micromhos at 25°C)	1,180	1,230	925	936
pH	7.9	8.3	8.0	
Temperature (°F)	79		88	
Depth of well (feet)	109.7	109.7	610	610
Analyzing laboratory	DWR	DWR	DWR	R
Laboratory number	R4195	R4143	R4070	25238

See footnotes at end of table.

Well number	4/16-31D1
Date of collection	6-10-61
Results in parts per million	
Silica (SiO_2)	17
Iron (Fe)	
Calcium (Ca)	16
Magnesium (Mg)	0
Sodium (Na)	201
Potassium (K)	2.7
Bicarbonate (HCO_3)	134
Carbonate (CO_3)	0
Sulfate (SO_4)	212
Chloride (Cl)	96
Fluoride (F)	9.5
Nitrate (NO_3)	5.6
Boron (B)	.61
Dissolved solids	
Calculated	626
Residue on evaporation at 180°C	604
Hardness as $CaCO_3$	40
Noncarbonate hardness as $CaCO_3$	0
Percent sodium	91
Specific conductance (micromhos at 25°C)	1,060
pH	8.0
Temperature (°F)	82
Depth of well (feet)	600
Analyzing laboratory	DWR
Laboratory number	R3939

Well number	4/16-32D1			
Date of collection	10-6-61	9-5-58	5-10-58[3/]	5-16-57
Results in parts per million				
Silica (SiO_2)	16		13	20
Iron (Fe)				
Calcium (Ca)	14		11	12
Magnesium (Mg)	0		2	1
Sodium (Na)	176		175	163
Potassium (K)	2.0		2.8	1.9
Bicarbonate (HCO_3)	63	59	70	70
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	171		168	164
Chloride (Cl)	113	118	135	110
Fluoride (F)	7.9		1.8	7.5
Nitrate (NO_3)	1.2		1.2	.5
Boron (B)	.41		.50	.55
Dissolved solids				
Calculated	532		544	514
Residue on evaporation at 180°C	512		598	523
Hardness as $CaCO_3$	35	35	35	33
Noncarbonate hardness as $CaCO_3$	0	0	0	0
Percent sodium	91		91	92
Specific conductance (micromhos at 25°C)	925	888	1,010	882
pH	7.1	7.5	7.7	8.2
Temperature (°F)		88		87
Depth of well (feet)	610	610	610	610
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	4193	T2531	T1859	7860

See footnotes at end of table.

Well number	4/16-32D1			
Date of collection	10-2-55 3/	9-17-54 2/	5-15-53 2/	4-12-53
Results in parts per million				
Silica (SiO_2)				
Iron (Fe)				
Calcium (Ca)		10	13	14
Magnesium (Mg)		0	0	2.9
Sodium (Na)		170	160	163
Potassium (K)		2.1	2.6	
Bicarbonate (HCO_3)	54	76	61	76
Carbonate (CO_3)	7	0	0	0
Sulfate (SO_4)		145	164	157
Chloride (Cl)	112	113	112	123
Fluoride (F)	9.6	3.2	11	
Nitrate (NO_3)		1.4	0	0
Boron (B)		.77	.44	.15
Dissolved solids				
Calculated		482	493	497
Residue on evaporation at 180°C		597	514	498
Hardness as $CaCO_3$	35	25	33	46
Noncarbonate hardness as $CaCO_3$	0	0	0	
Percent sodium		93	88	
Specific conductance (micromhos at 25°C)	875	833	779	838
pH	8.7	7.3	8.0	
Temperature (°F)		88		
Depth of well (feet)	610	610	610	610
Analyzing laboratory	DWR	DWR	DWR	H
Laboratory number	6132	R389	3176	70599

See footnotes at end of table.

Well number	4/16-32M1			
Date of collection	10-11-61 3/	5-16-61 3/	9-11-59	5-18-59
Results in parts per million				
Silica (SiO_2)	19	21	18	21
Iron (Fe)				
Calcium (Ca)	12	17	12	13
Magnesium (Mg)	0	0	1	1
Sodium (Na)	166	168	156	145
Potassium (K)	16	2.0	16	2.9
Bicarbonate (HCO_3)	43	43	34	46
Carbonate (CO_3)	0	0	6	0
Sulfate (SO_4)	162	167	156	147
Chloride (Cl)	124	129	124	106
Fluoride (F)	7.4	8.0	7.9	8.6
Nitrate (NO_3)	3.7	9.3	2.0	1.9
Boron (B)	.73	.58	.45	.33
Dissolved solids				
Calculated	532	542	516	470
Residue on evaporation at 180°C	508	522	493	441
Hardness as $CaCO_3$	30	43	35	38
Noncarbonate hardness as $CaCO_3$	0	8		0
Percent sodium	87	89	86	88
Specific conductance (micromhos at 25°C)	885	922	840	815
pH	8.2	7.2	8.7	7.8
Temperature (°F)			89	88
Depth of well (feet)	555	555	555	555
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	R4187	R3953	R2823	R2609

See footnotes at end of table.

Well number	4/17-6C1				
Date of collection	10-9-61	9-11-59	5-10-58	5-16-57	10-16-56[3/]
Results in parts per million					
Silica (SiO_2)	24		26	30	30
Iron (Fe)					
Calcium (Ca)	393		531	508	377
Magnesium (Mg)	14		36	10	11
Sodium (Na)	1,130		1,310	1,160	1,020
Potassium (K)	18		19	25	22
Bicarbonate (HCO_3)	49	76	67	71	68
Carbonate (CO_3)	0	0	0	0	0
Sulfate (SO_4)	442		399	380	342
Chloride (Cl)	2,100	2,800	2,750	2,420	2,000
Fluoride (F)	2.9		1.5	3.5	5.4
Nitrate (NO_3)	9.3		1.3	5.0	.7
Boron (B)	1.8		.50	1.5	1.1
Dissolved solids					
Calculated	4,160		5,110	4,580	3,840
Residue on evaporation at 180°C	4,380		4,740	6,060	4,740
Hardness as $CaCO_3$	1,040	1,440	1,500	1,310	986
Noncarbonate hardness as $CaCO_3$	998				
Percent sodium	69		66	65	69
Specific conductance (micromhos at 25°C)	6,900	9,120	8,470	7,940	6,620
pH	7.4	7.4	7.9	7.5	7.6
Temperature (°F)	82		79		
Depth of well (feet)	501	501	501	501	501
Analyzing laboratory	DWR	DWR	DWR	DWR	DWR
Laboratory number	R4192	R2799	T1358	7952	7383

See footnotes at end of table.

Well number	4/17-6C1				
Date of collection	5-31-56	10-2-55 3/	5-25-55 3/	9-17-54	5-21-52
Results in parts per million					
Silica (SiO_2)					
Iron (Fe)					
Calcium (Ca)				328	324
Magnesium (Mg)				48	16
Sodium (Na)				885	1,020
Potassium (K)				21	
Bicarbonate (HCO_3)	73	61	59	64	42
Carbonate (CO_3)	0	0	0	0	0
Sulfate (SO_4)	1,900			301	336
Chloride (Cl)		180	1,920	1,790	1,960
Fluoride (F)		3.0		10	6.8
Nitrate (NO_3)				4.3	3.7
Boron (B)					.9
Dissolved solids					
Calculated				3,420	3,690
Residue on evaporation at 180°C				3,670	4,370
Hardness as $CaCO_3$	913	814		1,020	877
Noncarbonate hardness as $CaCO_3$					
Percent sodium				65	72
Specific conductance (micromhos at 25°C)	5,990	5,160	5,810	5,950	6,320
pH	7.5	7.5	7.7	7.6	7.1
Temperature (°F)	77			82	76
Depth of well (feet)	501	501	501	501	501
Analyzing laboratory	DWR	DWR	DWR	DWR	DWR
Laboratory number	7035	6129	5764	R418	P165

See footnotes at end of table.

Well number	5/15-1L1	5/15-12N1	5/15-13B1	
Date of collection	3-21-60	5-18-61	5-18-61	10-10-59
Results in parts per million				
Silica (SiO_2)		29	28	
Iron (Fe)				
Calcium (Ca)	72	14	49	16
Magnesium (Mg)	10	0	5	2
Sodium (Na)	130	129	251	166
Potassium (K)	1.6	2.7	5.5	
Bicarbonate (HCO_3)	59	88	67	54
Carbonate (CO_3)	7	0	0	7
Sulfate (SO_4)	112	115	128	111
Chloride (Cl)	69	74	351	143
Fluoride (F)	12	8.7	6.8	17
Nitrate (NO_3)	1.9	8.7	6.8	1.8
Boron (B)	.48	.30	.56	.90
Dissolved solids				
Calculated	445	424	865	492
Residue on evaporation at 180°C	403	406	861	514
Hardness as $CaCO_3$	b221	35	143	
Noncarbonate hardness as $CaCO_3$		0	88	
Percent sodium	92	88	78	88
Specific conductance (micromhos at 25°C)	660	720	1,560	893
pH	8.7	7.9	7.8	
Temperature (°F)		82	87	
Depth of well (feet)	790	746	788	788
Analyzing laboratory	R	DWR	DWR	R
Laboratory number	24984	R3941	R3942	24788

Well number	5/15-23N1		5/15-27B1		
Date of collection	6-10-61	4-4-55	5-18-60[3]	5-10-58[3]	5-31-56[3]
Results in parts per million					
Silica (SiO_2)	31			17	
Iron (Fe)		.30			
Calcium (Ca)	62	74		28	24
Magnesium (Mg)	4	5.6		3	4.6
Sodium (Na)	350	399		131	124
Potassium (K)	13	5		6.5	3.9
Bicarbonate (HCO_3)	76	51	128	135	131
Carbonate (CO_3)	0	0	0	0	0
Sulfate (SO_4)	154	148		117	110
Chloride (Cl)	503	630	85	100	88
Fluoride (F)	4.8	4.6	4.8	2.2	5.4
Nitrate (NO_3)	8.7	.4		.6	0
Boron (B)	.59			.25	.60
Dissolved solids					
Calculated	1,170	1,290		472	426
Residue on evaporation at 180°C	1,150			486	457
Hardness as $CaCO_3$	170	207	83	84	80
Noncarbonate hardness as $CaCO_3$	108				
Percent sodium	80	b82		76	76
Specific conductance (micromhos at 25°C)	2,100		725	763	761
pH	8.1	7.8	7.3	7.8	7.7
Temperature (°F)	91				
Depth of well (feet)	409		644	644	644
Analyzing laboratory	DWR	SPH	DWR	DWR	DWR
Laboratory number	R3943	6207	R3236	T1890	V451

See footnotes at end of table.

Well number	5/15-27H1		
Date of collection	5-18-60[3]	9-5-58[3]	10-16-56[3]
Results in parts per million			
Silica (SiO_2)		17	35
Iron (Fe)			
Calcium (Ca)		159	137
Magnesium (Mg)		19	18
Sodium (Na)		446	425
Potassium (K)		22	16
Bicarbonate (HCO_3)	76	75	73
Carbonate (CO_3)	0	0	0
Sulfate (SO_4)		274	238
Chloride (Cl)	782	809	745
Fluoride (F)	4.0	6	3.5
Nitrate (NO_3)		6	3.5
Boron (B)		1.1	1.0
Dissolved solids			
Calculated		1,800	1,660
Residue on evaporation at 180°C		2,060	1,790
Hardness as $CaCO_3$	455	497	b416
Noncarbonate hardness as $CaCO_3$		417	
Percent sodium		66	b68
Specific conductance (micromhos at 25°C)	2,960	3,270	2,940
pH	7.3	8.1	7.6
Temperature (°F)			
Depth of well (feet)	598	598	598
Analyzing laboratory	DWR	DWR	DWR
Laboratory number	R3235	T2600	7300

See footnotes at end of table.

Well number	5/15-27H1			
Date of collection	5-25-55[4/]	1955	9-17-54[3/]	2-25-52
Results in parts per million				
Silica (SiO_2)				
Iron (Fe)		0		
Calcium (Ca)	153	127	136	96
Magnesium (Mg)	10	9.7	16	7
Sodium (Na)	480	445	447	410
Potassium (K)	16		17	16
Bicarbonate (HCO_3)	68	55	73	66
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	243	212	228	160
Chloride (Cl)	840	750	755	702
Fluoride (F)	6.0	4.2	9.2	
Nitrate (NO_3)	13	1.2	9.2	4.9
Boron (B)	1.0		1.8	.98
Dissolved solids				
Calculated	1,800	1,580	1,660	1,430
Residue on evaporation at 180°C	1,810	1,620	1,790	1,560
Hardness as $CaCO_3$	423	356	404	269
Noncarbonate hardness as $CaCO_3$				
Percent sodium	70		70	75
Specific conductance (micromhos at 25°C)	2,980		2,760	2,380
pH	7.8	7.9	8.1	8.0
Temperature (°F)				75
Depth of well (feet)	598	598	598	598
Analyzing laboratory	DWR	SPH	DWR	DWR
Laboratory number	5763	6208	R417	1652

See footnotes at end of table.

Well number	5/15-29F1			
Date of collection	10-11-61[5]	5-18-60[3]	5-10-58[3]	5-31-56[3]
Results in parts per million				
Silica (SiO_2)	24		24	
Iron (Fe)				
Calcium (Ca)	12		15	13
Magnesium (Mg)	2		0	.6
Sodium (Na)	82		88	94
Potassium (K)	2.3		2.8	2.4
Bicarbonate (HCO_3)	204	207	229	221
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	9		7	15
Chloride (Cl)	14	14	25	17
Fluoride (F)	3.9	3.4	1.4	3.0
Nitrate (NO_3)	25		15	20
Boron (B)	.28		.08	.16
Dissolved solids				
Calculated	274		291	274
Residue on evaporation at 180°C	252		283	330
Hardness as $CaCO_3$	40	34	39	b35
Noncarbonate hardness as $CaCO_3$	0			
Percent sodium	81		82	b84
Specific conductance (micromhos at 25°C)	433	425	450	464
pH	8.0	7.6	7.8	7.5
Temperature (°F)				
Depth of well (feet)	680	680	680	680
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	R4181	11550	T1893	V440

See footnotes at end of table.

Well number	5/16-5B1			
Date of collection	5-16-61	5-10-58[3/]	5-16-57[3/]	5-25-55[3/]
Results in parts per million				
Silica (SiO_2)	23	22	25	
Iron (Fe)				
Calcium (Ca)	16	14	12	15
Magnesium (Mg)	0	1	0	2
Sodium (Na)	161	167	168	165
Potassium (K)	3.1	3.9	3.0	3.2
Bicarbonate (HCO_3)	107	120	101	98
Carbonate (CO_3)	0	0	12	14
Sulfate (SO_4)	147	154	153	148
Chloride (Cl)	94	108	95	88
Fluoride (F)	7.0	2.2	7.0	12
Nitrate (NO_3)	12	.1	1.0	6.0
Boron (B)	.22	.30	.62	.58
Dissolved solids				
Calculated	516	532	527	502
Residue on evaporation at 180°C	479	533	515	505
Hardness as $CaCO_3$	40	39		46
Noncarbonate hardness as $CaCO_3$	0			
Percent sodium	89	89	b91	88
Specific conductance (micromhos at 25°C)	865	861	793	837
pH	7.9	7.5	8.3	8.6
Temperature (°F)	82			
Depth of well (feet)	114	114	114	114
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	R3954	T1895	7877	5765

See footnotes at end of table.

Well number	5/16-5a1	
Date of collection	5-25-55[7]	5-21-52[7]
Results in parts per million		
Silica (SiO_2)		
Iron (Fe)		
Calcium (Ca)	15	15
Magnesium (Mg)	2	1.6
Sodium (Na)	165	168
Potassium (K)	3.2	
Bicarbonate (HCO_3)	98	112
Carbonate (CO_3)	14	0
Sulfate (SO_4)	148	128
Chloride (Cl)	88	78
Fluoride (F)	12	35
Nitrate (NO_3)	6.0	6.2
Boron (B)	.58	.3
Dissolved solids		
Calculated	502	487
Residue on evaporation at 180°C	505	514
Hardness as $CaCO_3$	46	45
Noncarbonate hardness as $CaCO_3$		
Percent sodium	88	90
Specific conductance (micromhos at 25°C)	837	957
pH	8.6	8.0
Temperature (°F)		
Depth of well (feet)	114	114
Analyzing laboratory	DWR	DWR
Laboratory number		

See footnotes at end of table.

Well number	5/16-5B2		5/16-6N1	
Date of collection	5-17-61	6-27-60	9-26-61	5-17-61
Results in parts per million				
Silica (SiO_2)	20			18
Iron (Fe)				
Calcium (Ca)	9	8.8	8.4	6
Magnesium (Mg)	0	0	.5	2
Sodium (Na)	129	129	134	126
Potassium (K)	1.6			1.6
Bicarbonate (HCO_3)	79	78	73	67
Carbonate (CO_3)	0	1	0	0
Sulfate (SO_4)	108	107	110	106
Chloride (Cl)	74	73	82	74
Fluoride (F)	8.7	11	10	11
Nitrate (NO_3)	10	5.6	8.1	6.8
Boron (B)	.43	.52	.53	.49
Dissolved solids				
Calculated	400	374	390	385
Residue on evaporation at 180°C	386	406	418	362
Hardness as $CaCO_3$	23	b22	b23	23
Noncarbonate hardness as $CaCO_3$	0			0
Percent sodium	92	b93	93	92
Specific conductance (micromhos at 25°C)	687	692	704	618
pH	7.5	8.1		7.9
Temperature (°F)	90			87
Depth of well (feet)	715	715	723	723
Analyzing laboratory	DWR	R	R	DWR
Laboratory number	R3945	25093	25591	R3944

Well number	5/16-7M1			
Date of collection	10-8-61	2-29-60	5-18-59	5-10-58
Results in parts per million				
Silica (SiO_2)	23		26	14
Iron (Fe)				
Calcium (Ca)	12	11	12	14
Magnesium (Mg)	0	.6	.6	0
Sodium (Na)	134	137	136	145
Potassium (K)	2.3	2.7	3	3.1
Bicarbonate (HCO_3)	79	94	92	104
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	105	108	110	113
Chloride (Cl)	82	78	82	93
Fluoride (F)	6.8	7.5	7.6	6.2
Nitrate (NO_3)	14	9.9	9.9	10
Boron (B)	.29	.62	.45	.1
Dissolved solids				
Calculated	418	401	432	499
Residue on evaporation at 180°C	405	435	409	451
Hardness as $CaCO_3$	30	b30	33	35
Noncarbonate hardness as $CaCO_3$	0		0	0
Percent sodium	89	b90	89	89
Specific conductance (micromhos at 25°C)	717	716	700	735
pH	8.2	7.8	7.6	8.1
Temperature (°F)	96		94	93
Depth of well (feet)	648	648	648	648
Analyzing laboratory	DWR	R	DWR	DWR
Laboratory number	R4189	24931	R2615	T1847

Well number	5/16-7M2	5/16-7P1	
Date of collection	11-7-61[2]	5-18-59	2-11-58
Results in parts per million			
Silica (SiO_2)	19	22	24
Iron (Fe)			
Calcium (Ca)	6	8	9
Magnesium (Mg)	0	.6	1
Sodium (Na)	143	141	137
Potassium (K)	1.6	2.6	2.1
Bicarbonate (HCO_3)	55	88	83
Carbonate (CO_3)	12	0	0
Sulfate (SO_4)	106	105	107
Chloride (Cl)	89	78	76
Fluoride (F)	6.9	7.8	7.9
Nitrate (NO_3)	1.9	12	15
Boron (B)	.31	.31	.27
Dissolved solids			
Calculated	413	420	422
Residue on evaporation at 180°C	409	390	433
Hardness as $CaCO_3$	15	23	25
Noncarbonate hardness as $CaCO_3$	0	0	0
Percent sodium	95	92	92
Specific conductance (micromhos at 25°C)	717	700	694
pH	8.7	7.6	7.7
Temperature (°F)	86	90	
Depth of well (feet)	789	347	347
Analyzing laboratory	DWR	DWR	DWR
Laboratory number	R4190	R2616	R1869

See footnotes at end of table.

Well number	5/16-8F1		
Date of collection	5-10-53[3/]	5-16-57[3/]	5-25-55
Results in parts per million			
Silica (SiO_2)	21	25	
Iron (Fe)			
Calcium (Ca)	10	8	
Magnesium (Mg)	1	2	
Sodium (Na)	155	156	
Potassium (K)	2.8	2.1	
Bicarbonate (HCO_3)	105	109	90
Carbonate (CO_3)	0	0	7
Sulfate (SO_4)	144	140	
Chloride (Cl)	95	82	79
Fluoride (F)	2.2	8.0	
Nitrate (NO_3)	1.5	3.0	
Boron (B)	.35	.56	
Dissolved solids			
Calculated	485	481	
Residue on evaporation at 180°C	512	485	
Hardness as $CaCO_3$	30		
Noncarbonate hardness as $CaCO_3$			
Percent sodium	91	b73	
Specific conductance (micromhos at 25°C)	787	806	702
pH	8.0	8.0	8.2
Temperature (°F)			82
Depth of well (feet)	206	206	206
Analyzing laboratory	DWR	DWR	DWR
Laboratory number	T1896	7930	5768

See footnotes at end of table.

Well number	5/16-8F1		
Date of collection	9-17-54[3]	6-?-52	5-21-52[3]
Results in parts per million			
Silica (SiO_2)			
Iron (Fe)			
Calcium (Ca)	12		7.2
Magnesium (Mg)			1.1
Sodium (Na)	151		162
Potassium (K)	2.4		
Bicarbonate (HCO_3)	104	74	104
Carbonate (CO_3)	2	16	1
Sulfate (SO_4)	132	130	135
Chloride (Cl)	81	84	88
Fluoride (F)	1.6		13
Nitrate (NO_3)	7.1		3.7
Boron (B)	.70	.40	.50
Dissolved solids			
Calculated	441		462
Residue on evaporation at 180°C	474		478
Hardness as $CaCO_3$	30	40	22
Noncarbonate hardness as $CaCO_3$			
Percent sodium	91	88	94
Specific conductance (micromhos at 25°C)	788	917	770
pH	8.4	8.7	8.3
Temperature (°F)			
Depth of well (feet)	206	206	206
Analyzing laboratory	DWR	H	DWR
Laboratory number	R390	66347	P173

See footnotes at end of table.

Well number	5/16-10Z1	5/16-18M1	
Date of collection	12-17-17[1/]	11-7-61	6-27-60
Results in parts per million			
Silica (SiO_2)	43	24	
Iron (Fe)	.40		
Calcium (Ca)	399	5	64
Magnesium (Mg)	7.3	0	0
Sodium (Na)	a699	158	149
Potassium (K)		.8	
Bicarbonate (HCO_3)	129	67	73
Carbonate (CO_3)	0	12	7
Sulfate (SO_4)	1,950	122	120
Chloride (Cl)	286	85	85
Fluoride (F)		8.9	9.0
Nitrate (NO_3)	8.8	9.9	11
Boron (B)		.37	.61
Dissolved solids			
Calculated	3,460	459	482
Residue on evaporation at 180°C	1,030	421	453
Hardness as $CaCO_3$	b1,020	13	b160
Noncarbonate hardness as $CaCO_3$		0	
Percent sodium		96	b95
Specific conductance (micromhos at 25°C)		748	753
pH		8.6	8.4
Temperature (°F)		95	
Depth of well (feet)		790	790
Analyzing laboratory		DWR	R
Laboratory number		R4191	25094

See footnotes at end of table.

Well number	5/16-22N1	5/16-25F1		
Date of collection	9-12-61[2/]	6-5-58	5-10-58	5-31-56
Results in parts per million				
Silica (SiO_2)	12		12	
Iron (Fe)				
Calcium (Ca)	72	c40	40	37
Magnesium (Mg)	0		2	2.3
Sodium (Na)	409	200	198	193
Potassium (K)	4.7		6.1	5.7
Bicarbonate (HCO_3)	21	92	92	90
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	144	120	120	124
Chloride (Cl)	645	238	248	222
Fluoride (F)	3.1		5.0	5.7
Nitrate (NO_3)	5.6	3.7	3.7	6.2
Boron (B)	.38	.94	.20	1.0
Dissolved solids				
Calculated	1,310	648	680	641
Residue on evaporation at 180°C	1,340	681	739	680
Hardness as $CaCO_3$	178		110	b101
Noncarbonate hardness as $CaCO_3$	160			
Percent sodium	83	b81	78	b76
Specific conductance (micromhos at 25°C)	2,410	1,170	1,220	1,170
pH	8.0	8.0	7.9	7.4
Temperature (°F)	92		88	86
Depth of well (feet)	515.7	680	680	680
Analyzing laboratory	DWR	R	DWR	DWR
Laboratory number	R4142	24246	T1845	V449

See footnotes at end of table.

Well number	5/16-36M1		
Date of collection	9-11-59	5-10-58	5-31-56
Results in parts per million			
Silica (SiO_2)	20	19	
Iron (Fe)			
Calcium (Ca)	20	20	18
Magnesium (Mg)	2	2	2.8
Sodium (Na)	159	141	150
Potassium (K)	4.3	4.6	4.6
Bicarbonate (HCO_3)	116	128	116
Carbonate (CO_3)	6	0	0
Sulfate (SO_4)	113	124	120
Chloride (Cl)	131	90	107
Fluoride (F)	5.2	1.8	6.0
Nitrate (NO_3)	6.2	1.2	4.3
Boron (B)	.68	.29	1.0
Dissolved solids			
Calculated	524	467	471
Residue on evaporation at 180°C	455	479	493
Hardness as $CaCO_3$	60	60	b57
Noncarbonate hardness as $CaCO_3$			
Percent sodium	84	82	b84
Specific conductance (micromhos at 25°C)	808	787	820
pH	8.3	7.8	7.8
Temperature (°F)	81	82	79
Depth of well (feet)	357		
Analyzing laboratory	DWR	DWR	DWR
Laboratory number	R2812	T1884	V450

Well number	5/17-20F1		5/17-30F1	5/17-30P1
Date of collection	5-10-58[2]	5-16-57[2]	1960	5-16-57[2]
Results in parts per million				
Silica (SiO_2)	22	15		5
Iron (Fe)				
Calcium (Ca)	50	25	c30	12
Magnesium (Mg)	6	3		2
Sodium (Na)	225	220	240	240
Potassium (K)	.7	9.0		75
Bicarbonate (HCO_3)	104	122	90	420
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	241	173	155	89
Chloride (Cl)	203	198	225	150
Fluoride (F)	1.8	5.0		.3
Nitrate (NO_3)	2.1	5.5		2.0
Boron (B)	.10	.84	.6	.38
Dissolved solids				
Calculated	803	714	695	783
Residue on evaporation at 180°C	871	725	720	795
Hardness as $CaCO_3$	150	75	b75	b38
Noncarbonate hardness as $CaCO_3$				
Percent sodium	76	b85	b85	b80
Specific conductance (micromhos at 25°C)	1,320	1,140		1,160
pH	7.4	7.4	8.1	8.0
Temperature (°F)	75	77		79
Depth of well (feet)	10	10	720	152.
Analyzing laboratory	DWR	DWR	CL	DWR
Laboratory number	T1857	7376	31408	7375

See footnotes at end of table.

Well number	5/17-33N1	5/20-16Ms		
Date of collection	10-11-61[2]	5-19-61	5-20-52	11-1-17[1]
Results in parts per million				
Silica (SiO_2)	8	52		53
Iron (Fe)				.46
Calcium (Ca)	7	93	102	19
Magnesium (Mg)	2	34	23	11
Sodium (Na)	331	515	405	a219
Potassium (K)	31	15		
Bicarbonate (HCO_3)	464	571	296	356
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	45	97	233	77
Chloride (Cl)	216	656	533	137
Fluoride (F)	3.6	1.1		2.2
Nitrate (NO_3)	3.7	9.9	1.2	
Boron (B)	1.3	.96	.9	
Dissolved solids				
Calculated	877	1,760	1,440	694
Residue on evaporation at 180°C	859	1,730	1,560	
Hardness as $CaCO_3$	25	385	348	b93
Noncarbonate hardness as $CaCO_3$	0	0		
Percent sodium	91	73	72	
Specific conductance (micromhos at 25°C)	1,520	3,080	2,610	
pH	7.5	7.6	7.5	
Temperature (°F)	81	79	82	
Depth of well (feet)	758	Spring	Spring	Spring
Analyzing laboratory	DWR	DWR	DWR	
Laboratory number	R4186	R3957	P45	

See footnotes at end of table.

Well number	6/15-24E1	6/15-24E3	6/15-30Q1	6/16-28D1
Date of collection	8-4-61	5-22-52	5-22-52	5-22-52[2]
Results in parts per million				
Silica (SiO_2)	32			
Iron (Fe)				
Calcium (Ca)	60	76	72	158
Magnesium (Mg)	10	16	16	30
Sodium (Na)	25	42	59	111
Potassium (K)	4.7			
Bicarbonate (HCO_3)	177	247	308	494
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	13	55	29	80
Chloride (Cl)	62	64	60	183
Fluoride (F)	1.0	1.8	.6	
Nitrate (NO_3)	16	3.7	18	5.0
Boron (B)	.09	0	.1	5.1
Dissolved solids				
Calculated	311	380	407	815
Residue on evaporation at 180°C	302	420	460	1,030
Hardness as $CaCO_3$	193	256	b246	520
Noncarbonate hardness as $CaCO_3$	48	0		
Percent sodium	22	26	b34	b32
Specific conductance (micromhos at 25°C)	485	677	664	1,820
pH	7.6	7.4	7.6	7.4
Temperature (°F)	77	70	64	71
Depth of well (feet)	22	14	14.8	14.0
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	R4071	P156	P147	P153

See footnotes at end of table.

Well number	6/17-3M1	6/19-25P1	6/19-33A1	
Date of collection	1959	10-10-61 2/	1959	10-17-17 1/
Results in parts per million				
Silica (SiO_2)		21		12
Iron (Fe)				.13
Calcium (Ca)	c26	206	c46	49
Magnesium (Mg)		23		2.7
Sodium (Na)		1,820	851	a699
Potassium (K)		21		
Bicarbonate (HCO_3)	79	73	543	38
Carbonate (CO_3)		0		0
Sulfate (SO_4)		1,720		374
Chloride (Cl)	131	1,770	986	872
Fluoride (F)		3.3		
Nitrate (NO_3)		107		Trace
Boron (B)	2.5	3.6	1.5	
Dissolved solids				
Calculated		5,730	2,150	2,030
Residue on evaporation at 180°C		5,740		2,060
Hardness as $CaCO_3$		610	b115	134
Noncarbonate hardness as $CaCO_3$		550		
Percent sodium		86	b94	
Specific conductance (micromhos at 25°C)		8,180		
pH	7.4	7.9	7.9	
Temperature (°F)		80		
Depth of well (feet)	818	85.7	63.2	63.2
Analyzing laboratory	DWR	DWR	UC	
Laboratory number	R595	R4188	R604	

See footnotes at end of table.

Well number	6/20-30Z1	7/18-11M1	7/18-11R1	7/19-4R1
Date of collection	10-17-17[1/]	10-10-61[2/]	10-10-61[2/]	10-10-61[2/]
Results in parts per million				
Silica (SiO_2)	37	3	11	16
Iron (Fe)	1.0			
Calcium (Ca)	32	30	32	12
Magnesium (Mg)	2.4	13	13	13
Sodium (Na)	a1,300	736	456	1,020
Potassium (K)		9.4	4.3	23
Bicarbonate (HCO_3)	203	55	165	1,490
Carbonate (CO_3)	0	0	0	0
Sulfate (SO_4)	1,420	666	590	1
Chloride (Cl)	865	718	273	734
Fluoride (F)		1.7	2.5	5.7
Nitrate (NO_3)	66	3.7	9.9	2.5
Boron (B)		3.2	1.2	2.4
Dissolved solids				
Calculated	3,820	2,210	1,470	2,560
Residue on evaporation at 180°C	3,910	2,190	1,450	2,350
Hardness as $CaCO_3$	90	128	135	84
Noncarbonate hardness as $CaCO_3$		83	0	0
Percent sodium		92	88	95
Specific conductance (micromhos at 25°C)		3,570	2,300	4,360
pH		7.9	8.1	7.9
Temperature (°F)		85	83	86
Depth of well (feet)		486.4	779.4	242.2
Analyzing laboratory		DWR	DWR	DWR
Laboratory number		R4130	R4182	R4185

See footnotes at end of table.

Well number	7/20-4R1	7/20-18H1		
Date of collection	10-10-61[2]	6-12-61	3-2-60	9-1-59
Results in parts per million				
Silica (SiO_2)	18	31		
Iron (Fe)				
Calcium (Ca)	130	11	11	c12
Magnesium (Mg)	34	0	.4	
Sodium (Na)	2,860	283	257	258
Potassium (K)	16	2.0	1.6	
Bicarbonate (HCO_3)	107	30	34	28
Carbonate (CO_3)	0	9	10	Trace
Sulfate (SO_4)	1,730	211	217	221
Chloride (Cl)	3,250	216	213	214
Fluoride (F)	2.7	2.6	9.5	
Nitrate (NO_3)	48	98	Trace	Trace
Boron (B)	2.7	1.0	1.5	1.4
Dissolved solids				
Calculated	8,150	880	738	720
Residue on evaporation at 180°C	8,130	762	763	754
Hardness as $CaCO_3$	465	28	b29	b30
Noncarbonate hardness as $CaCO_3$	378	0		
Percent sodium	92	95	b95	b95
Specific conductance (micromhos at 25°C)	11,600	1,250	1,290	1,310
pH	7.3	8.6	8.8	7.7
Temperature (°F)	89	114		
Depth of well (feet)	315.7	1,139	1,139	1,139
Analyzing laboratory	DWR	DWR	R	R
Laboratory number	R4194	R3976	24947	24740

See footnotes at end of table.

Well number	8/20-10M1		
Date of collection	10-11-61[2/]	5-22-52	11-7-17[1/]
Results in parts per million			
Silica (SiO_2)	23		69
Iron (Fe)			.17
Calcium (Ca)	395	568	152
Magnesium (Mg)	54	50	15
Sodium (Na)	293	343	b177
Potassium (K)	5.1		
Bicarbonate (HCO_3)	183	283	225
Carbonate (CO_3)	0	0	16
Sulfate (SO_4)	1,300	1,490	376
Chloride (Cl)	206	401	151
Fluoride (F)	.7	1.7	
Nitrate (NO_3)	3.1	100	12
Boron (B)	.63	1.2	
Dissolved solids			
Calculated	2,370	3,090	1,080
Residue on evaporation at 180°C	2,460	3,260	1,110
Hardness as $CaCO_3$	1,200	1,630	442
Noncarbonate hardness as $CaCO_3$	1,060		
Percent sodium	33	31	
Specific conductance (micromhos at 25°C)	2,950	3,770	
pH	7.3	7.1	
Temperature (°F)	76	70	
Depth of well (feet)	37.8	37.8	45
Analyzing laboratory	DWR	DWR	
Laboratory number	R4184	P170	

1. Analysis from U.S. Geological Survey Water-Supply Paper 497, p. 283.
2. Sampled with grab-sampler.
3. Sampled from tank.
4. Sampled from reservoir.
5. Sampled from faucet at service station.
6. Sample taken after well bailed.
7. Analysis from State of California, Department of Public Works, Division of Water Resources, Office Report on Water Well and Ground Water Data in Pahrump, Mesquite, Ivanpah, Lanfair, Fenner, Chuckwalla, and Jacumba Valleys, 1956, p. 33-34.

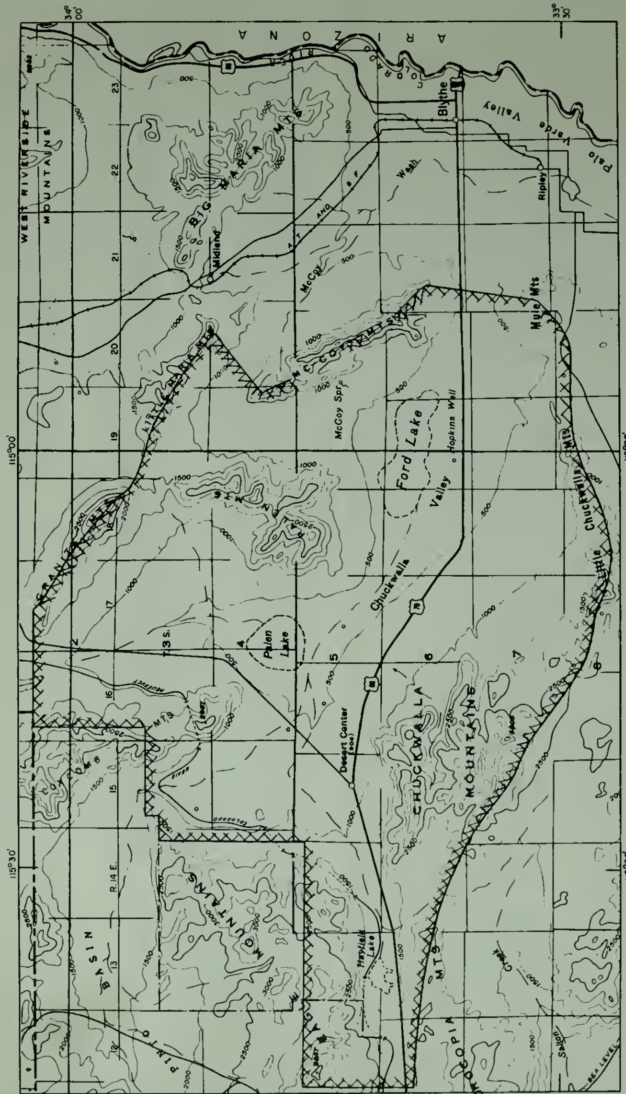


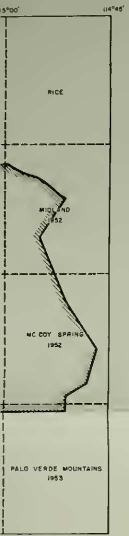
FIGURE 1.—Map of part of southern California showing area described by this report

Base map from U. S. Geological Survey topographic map of State of California, south half, scale 1:500,000

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

FEDERAL-STATE COOPERATIVE GROUND WATER INVESTIGATIONS

U. S. GEOLOGICAL SURVEY



IC QUADRANGLE MAPS

EXPLANATION

UNCONSOLIDATED DEPOSITS

QUATERNARY

Recent

Qya

Younger alluvium

Poorly sorted gravel, sand, clay, and silt, unconsolidated, commonly overlies older units as a thin veneer, largely above the water table, if saturated, probably yields water freely to wells

Qp

Playa deposits

Clay, silt and sand, unconsolidated, relatively impermeable, do not yield water readily to wells

Qs

Windblown sand

Sand, unconsolidated, actively drifting, locally anchored by vegetation, apparently above the water table and is not considered a water-bearing unit

Pleistocene

Qoa

Older alluvium

Sand, well sorted, interbedded with gravel, silt and clay, unconsolidated to poorly indurated, where saturated yields water freely to wells

Ql

Lacustrine deposits

Clay, interbedded with well-sorted, very fine sand and silt, locally gypsiferous, unconsolidated to moderately indurated, locally dissected, may yield small amounts of water to wells

Qf

Fan deposits

Poorly sorted boulders, sand, silt, and clay, unconsolidated to moderately indurated, locally dissected, desert pavement locally well-developed, generally above the water table and, therefore, yield little water to wells

CONSOLIDATED ROCKS

PRE-TERTIARY

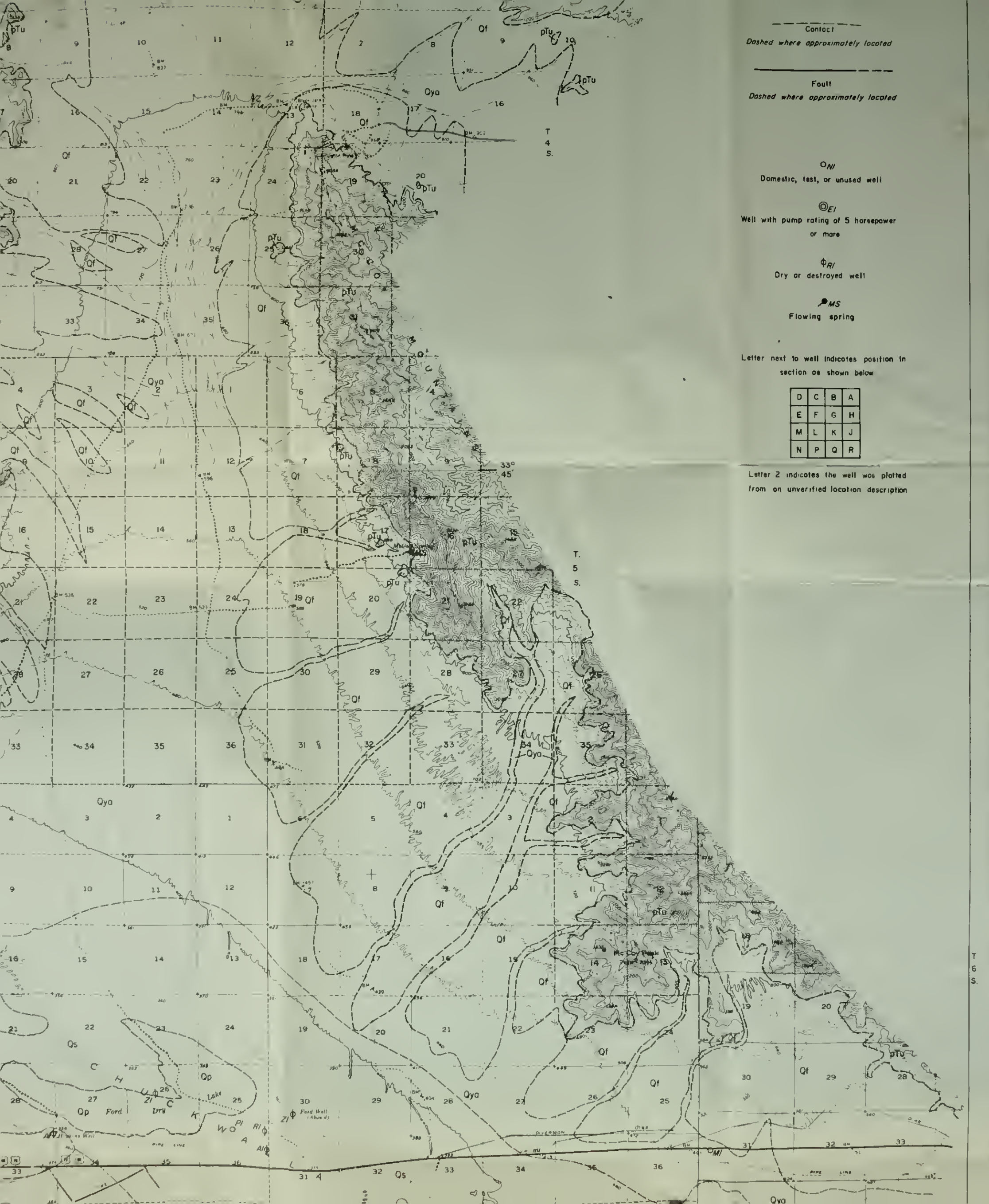
pTu

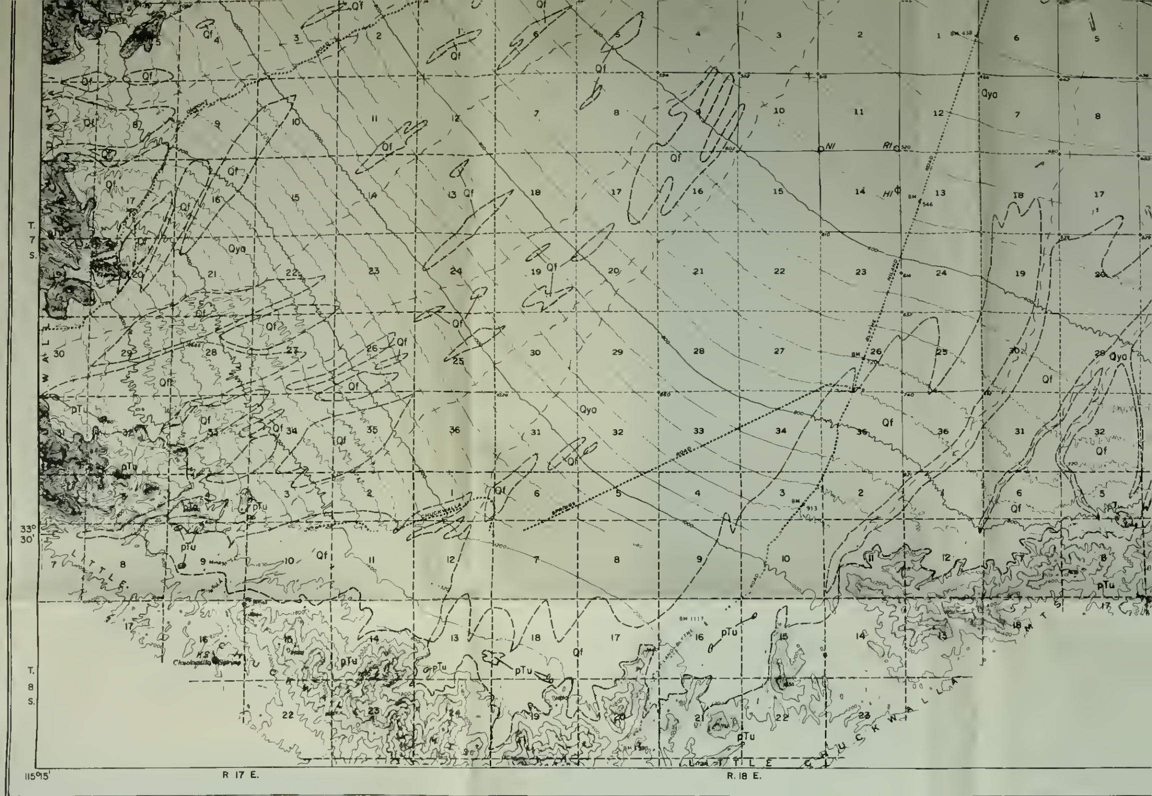
Basement complex

Metamorphic and igneous intrusive rocks of pre-Tertiary age, overlain in places by igneous extrusive rocks of Tertiary age, virtually not water bearing except for minor amounts from cracks and residuum

MAP SYMBOLS

T 4 S.
T. 5 S.
T 6 S
33° 45'
CHUCKWALLA
SAND DUNES
DEPRESSION
PALEN DRY LAKE
CHUCKWALLA VALLEY
(DEPRESSION)
Ford Lake
Airway Beacon
Qf
Qya
Qs
Qp
pTu
Qoa


Contact
Dashed where approximately located
Fault
Dashed where approximately located
○NI
Domestic, test, or unused well
◎EI
Well with pump rating of 5 horsepower or more
ϕRI
Dry or destroyed well
MS
Flowing spring
Letter next to well indicates position in section as shown below
D C B A
E F G H
M L K J
N P Q R
Letter Z indicates the well was plotted from an unverified location description
T 4 S.
T. 5 S.
T 6 S.
33° 45'
Mc Coy Peak
Ford Well (Aband)
Ford Dry Lake
CHUCKWALLA
PIPE LINE
Qf
Qya
Qp
Qs
pTu



Base from U.S. Geological Survey
topographic maps, scale 1:62,500,
1962

BULLETIN NO. 91-7

MAP OF THE EASTERN PART OF THE

SHOWING RECONNAISSANCE GEOLOG

Geology and location of wells by F. W Giessner, 1961. Fault pattern of Palen Mountains after R. A. Hoppin, 1954

CHUCKWALLA VALLEY AREA, CALIFORNIA

Y AND LOCATION OF WELLS AND SPRINGS

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

FEDERAL-STATE COOPERATIVE GROUND WATER INVESTIGATIONS

PREPARED BY U. S. GEOLOGICAL SURVEY
1963

SCALE 1:62500

TOUR INTERVALS 40 AND 80 FEET

U. S GEOLOGICAL SURVEY

EXPLANATION

UNCONSOLIDATED DEPOSITS

Recent

Qya

Younger alluvium

Poorly sorted gravel, sand, clay, and silt, unconsolidated, commonly overlies older units as a thin veneer, largely above the water table, if saturated, probably yields water freely to wells

Qp

Playa deposits

Clay, silt and sand, unconsolidated, relatively impermeable, do not yield water readily to wells

Qs

Windblown sand

Sand, unconsolidated, actively drifting, locally anchored by vegetation, apparently above the water table and is not considered a water-bearing unit

Pleistocene

Ql

Locustrine deposits

Clay, interbedded with well-sorted, very fine sand and silt, locally gypsiferous, unconsolidated to moderately indurated, locally dissected, may yield small amounts of water to wells

Qf

Fan deposits

Poorly sorted boulders, gravel, sand, silt, and clay, unconsolidated to moderately indurated, locally dissected, desert pavement locally well-developed, generally above the water table and, therefore, yield little water to wells

Qpf **Qpb**

Pinto Formation of Scharf (1935)

Coarse bouldery fanglomerate and locustrine clay (Qpf), unconsolidated, yields water freely to wells, interbedded with basalt (Qpb) which yields little water to wells

QUATERNARY

CONSOLIDATED ROCKS

pTu

Basement complex

Metamorphic and igneous intrusive rocks of pre-Tertiary age, overlain in places by igneous extrusive rocks of Tertiary age, virtually not water-bearing except for minor amounts from cracks and residuum

PRE-TERTIARY

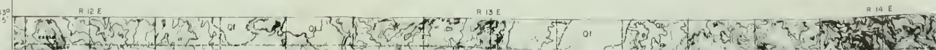
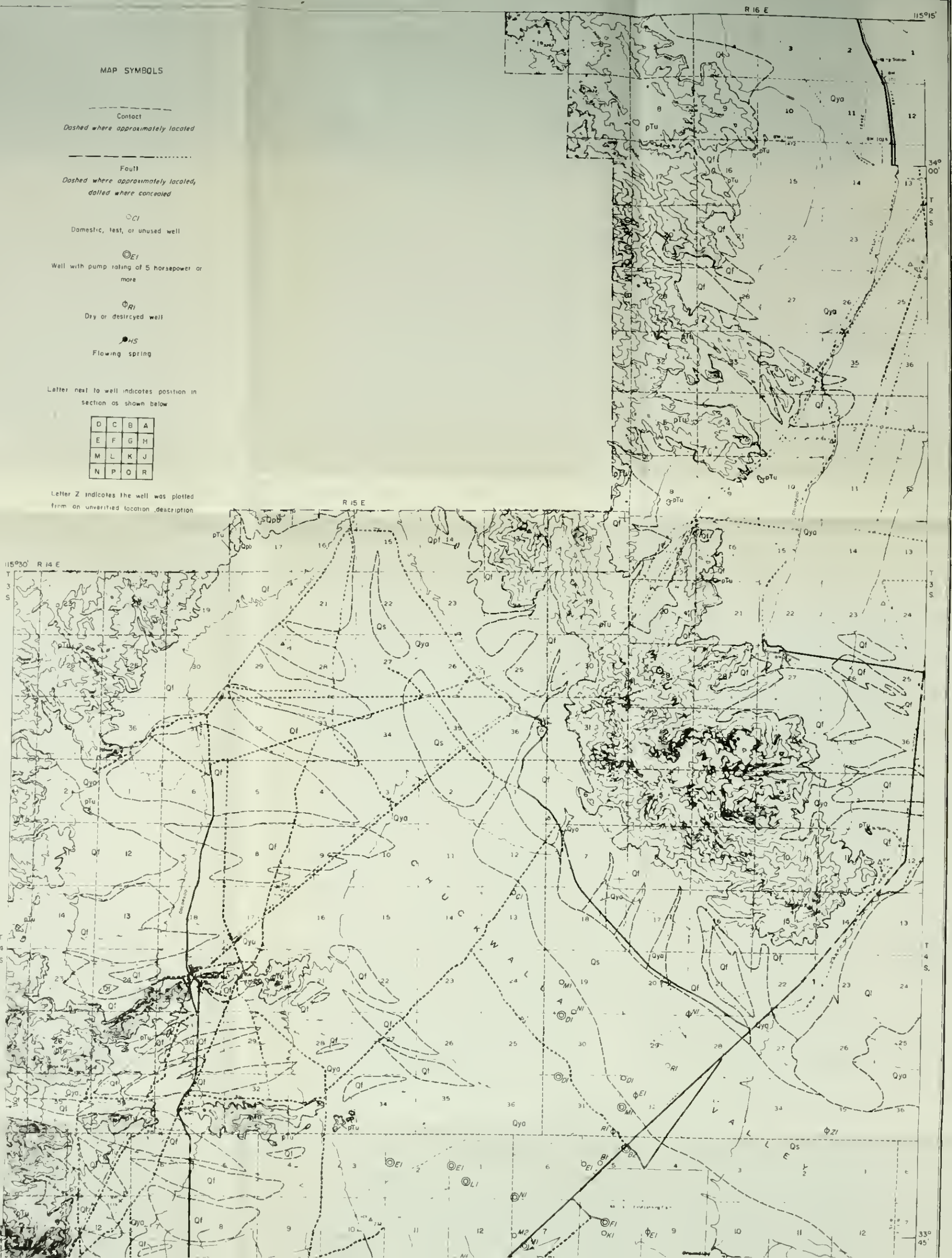
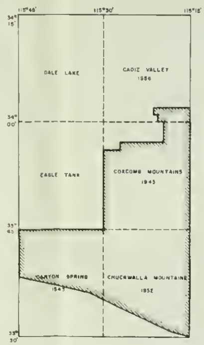


FIGURE 3


MAP SYMBOLS
Contact
Dashed where approximately located
Fault
Dashed where approximately located, dotted where concealed
Domestic, test, or unused well
Well with pump rating of 5 horsepower or more
Dry or destroyed well
Flowing spring
Letter next to well indicates position in section as shown below
D C B A
E F G H
M L K J
N P Q R
Letter Z indicates the well was plotted from an unverified location description
R 16 E
R 15 E
R 14 E
115°15'
115°30'
34° 00'
33° 45'
T 2 S
T 3 S
T 4 S
C H U C K W A L L A
V A L L E Y



INDEX TO TOPOGRAPHIC QUADRANGLE MAPS

INDEX MAP OF CALIFORNIA

MAP OF THE WESTERN PART OF THE

SHOWING RECONNAISSANCE GEOLOGY

Base from U S Geological Survey and Army Map Service topographic maps, scale 1:62,500, 1962

BULLETIN NO. 91-7

CHUCKWALLA VALLEY AREA, CALIFORNIA

Y AND LOCATION OF WELLS AND SPRINGS

Geology and location of wells by
F W Giessner, 1961

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

FEDERAL-STATE COOPERATIVE GROUND WATER INVESTIGATIONS

PREPARED BY U S GEOLOGICAL SURVEY
1963

THE RESOURCES AGENCY OF CALIFORNIA

Department of Water Resources

BULLETIN No. 91-8

DATA ON WATER WELLS AND SPRINGS IN THE RICE AND VIDAL VALLEY AREAS

RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA

Prepared by

UNITED STATES DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

FEDERAL-STATE COOPERATIVE GROUND WATER INVESTIGATIONS

MAY 1963

HUGO FISHER	EDMUND G. BROWN	WILLIAM E. WARNE
Administrator	*Governor*	*Director*
The Resources Agency of California	State of California	Department of Water Resources

State of California
THE RESOURCES AGENCY OF CALIFORNIA
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This report is one of a series of open file reports prepared by the United States Department of Interior Geological Survey, Ground Water Branch, which presents basic data on wells obtained from reconnaissance surveys of desert areas. These investigations are conducted by the Geological Survey under a cooperative agreement whereby funds are furnished equally by the United States and the State of California. The reports in this Bulletin No. 91 series are being published by the Department of Water Resources in order to make sufficient copies available for use of all interested agencies and the public at large. Earlier reports of this series are:

Bulletin No. 91-1
Data on Wells in the West Part of the Middle Mojave Valley Area, San Bernardino County, California

Bulletin No. 91-2
Data on Water Wells and Springs in the Yucca Valley-Twentynine Palms Area, San Bernardino and Riverside Counties, California

Bulletin No. 91-3
Data on Water Wells in the Eastern Part of the Middle Mojave Valley Area, San Bernardino County, California

Bulletin No. 91-4
Data on Water Wells in the Willow Springs, Gloster, and Chaffee Areas, Kern County, California

Bulletin No. 91-5
Data on Water Wells in the Dale Valley Area, San Bernardino and Riverside Counties, California

Bulletin No. 91-6
Data on Wells in the Edwards Air Force Base Area, California

Bulletin No. 91-7
Data on Water Wells and Springs in the Chuckwalla Valley Area, Riverside County, California

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division
Ground Water Branch
Sacramento 14, California

February 11, 1963

Mr. William E. Warne, Director
California Department of Water Resources
P. O. Box 388
Sacramento 2, California

Dear Mr. Warne:

We are pleased to transmit herewith, for publication by the Department of Water Resources, the U.S. Geological Survey report, "Data on Water Wells and Springs in the Rice and Vidal Valley Areas, Riverside and San Bernardino Counties, California," by F. W. Giessner.

This report, one of a series for the Mojave Desert region, was prepared by the Long Beach subdistrict office of the Geological Survey in accordance with the cooperative agreement between the State of California and the Geological Survey. It tabulates all available data on wells and springs in the Rice and Vidal Valley areas and shows reconnaissance geology with special reference to the water-yielding deposits.

Sincerely yours,

Fred Kunkel

Fred Kunkel
District Geologist

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Purpose and scope of the study	3
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Geologic and hydrologic features	7
Previous work and acknowledgments	11
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ILLUSTRATIONS

(All illustrations are at end of report)

Figure 1. Map of part of southern California showing area described by this report

2. Map of the Rice and Vidal Valley areas, California, showing reconnaissance geology and location of wells and springs

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DATA ON WATER WELLS AND SPRINGS IN THE RICE AND VIDAL VALLEY AREAS, RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA

By F. W. Giessner

PURPOSE AND SCOPE OF THE STUDY

The desert areas of southern California, of which the Rice and Vidal Valleys are a part (fig. 1), are broad valleys or basins that have been partly filled by alluvial deposits and are surrounded by nearly barren mountain ranges. These basins contain ground water that varies widely in chemical quality and is potentially available for development for irrigation, industrial, and domestic supply.

The objective of the investigation was the collection and tabulation of all available hydrologic data for use in planning orderly development and utilization of the ground-water resources, as well as providing a basis for subsequent detailed ground-water studies.

Fieldwork by the U.S. Geological Survey in the area included: (1) A very brief reconnaissance of the major geologic features to define the extent and general character of the deposits that contain ground water; (2) an inventory and examination of virtually all the water wells in the area to determine and record their locations in relation to geographic and cultural features and the public-land net, and to record the depths and sizes of the wells, the types and capacities of installed pumping equipment, uses of the water, and other pertinent information; (3) the measurement and recording of the depth to the water surface in wells, below established and described measuring points at or near the land surface; (4) the selection of representative wells and the periodic measurements of water level in these wells in order to detect changes of water levels; and (5) the collection and compilation of well records, including well logs, water-level measurements, and chemical analyses.

This study has been made by the U.S. Department of the Interior, Geological Survey, as a part of the cooperative program with the California Department of Water Resources to investigate the ground-water resources of the desert areas. Fieldwork and preparation of the report have been under the general supervision of Fred Kunkel, district geologist in charge of ground-water investigations in California, and under the immediate supervision of G. M. Hogenson, geologist in charge of the Long Beach subdistrict office.

LOCATION AND GENERAL FEATURES OF THE AREA

Rice and Vidal Valleys are located in the desert region of southern California between long 114°30' and 114°57' W. and lat 33°52' and 34°20' N. The boundaries as shown on figures 1 and 2 include all or parts of the following U.S. Geological Survey and Army Map Service topographic quadrangle maps at a scale of 1:62,500: Big Maria Mountains, Midland, Rice, Savahia Peak, Turtle Mountains, and Vidal. (See index map on fig. 2.)

The total area of Rice and Vidal Valleys, as described in this report (fig. 1), consists of about 710 square miles. Individually, the two valleys are approximately equal in area, each containing about 355 square miles.

Access to the area is provided by U.S. Highway 95, the Parker Dam Highway and the unpaved Rice to Midland road.

Rice Valley is an area of internal drainage with no perennial streams. It consists of a nearly circular alluviated valley bounded on the south by the Little Maria and the Big Maria Mountains. The western boundary is formed by the Arica Mountains which are separated from the Little Maria Mountains to the south and the Turtle Mountains to the north by low alluviated drainage divides. The Turtle Mountains provide the northern boundary of the basin and are separated by an alluviated drainage divide from the West Riverside and Riverside Mountains which mark the eastern extent of the area.

Vidal Valley is also an area of internal drainage with no perennial streams. It is a valley of irregular shape, bounded on the south by the West Riverside and Riverside Mountains, on the west by the Turtle Mountains, and on the north by the Turtle and Whipple Mountains. The eastern boundary of the valley is formed by the Colorado River; however, the area of study does not extend eastward to include this portion of the valley. The east edge of the Vidal quadrangle lies approximately 0.5 mile east of Vidal and is used to define the eastern boundary of the area of study.

GEOLOGIC AND HYDROLOGIC FEATURES

The geologic units in the Rice and Vidal Valley areas are grouped into two broad categories: consolidated rocks and unconsolidated deposits.

The consolidated rocks include the metamorphic and igneous intrusive rocks of pre-Tertiary age that form the basement complex, and some undifferentiated volcanic rocks of Tertiary(?) and Quaternary(?) age. The volcanic rocks consist mainly of basalt flows. Some are of felsic composition. The consolidated rocks are not water bearing, except for minor amounts of water contained in cracks and residuum.

The extent of the volcanic rocks, shown on figure 2, is based primarily on aerial photographs. Therefore, some areas designated as basement complex may be locally overlain by volcanic rocks. Also, isolated areas of basement complex may be included in the area mapped as volcanic rocks.

The unconsolidated deposits consist of sedimentary material deposited in a continental environment, mainly during Quaternary time. Most of the material was waterlain as alluvial-fan, stream-channel, lake, or playa deposits, but some of the sand was deposited by the wind. Six units, shown on figure 2, make up the unconsolidated rocks. These are the older alluvium, the lacustrine deposits, and the fan deposits, all of Pleistocene age; the younger alluvium, the playa deposits, and the windblown sand, all of Recent age.

The lacustrine deposits of Pleistocene age consist of bentonitic clay interbedded with very fine sand and silt. The deposits are flat-lying, moderately indurated, and, locally, dissection has resulted in vertical exposures of as much as 50 feet. The absence of coarse fragmental material and the presence of clay interbedded with fine sand and silt differentiates the lacustrine deposits from the overlying alluvial fans. These deposits would probably yield only small amounts of water to wells.

The older alluvium is of Pleistocene age and consists of fine to coarse sand interbedded with gravel, silt, and clay. The color ranges from dark brown to red, with numerous small white nodules of caliche which give it a speckled appearance. The older alluvium yields water freely to wells and probably is the most important aquifer in the area.

The fan deposits of Pleistocene age are poorly sorted and consist of boulders, very coarse to fine gravel, sand, silt, and clay. The fans extend into the valley from the surrounding mountains and are characterized by local areas of well-developed desert pavement. This deposit is generally above the water table and is not considered to be a water-bearing unit. Where saturated, the fan deposits may yield small amounts of water to wells.

The younger alluvium of Recent age consists of poorly sorted gravel, sand, silt, and clay. This deposit is permeable, but it overlies many of the geologic units in the Rice and Vidal Valley areas as a thin veneer and is believed to be mostly above the water table. If saturated, the deposit probably would yield water freely to wells.

The playa deposits of Recent age consist mainly of clay, silt, and sand. They are relatively impermeable and probably will not yield water readily to wells.

The windblown sand of Recent age consists of actively drifting sand and some dunes which are anchored by vegetation. This unit mainly occupies the lower elevations of the valleys and varies in thickness from 0 to 15 feet. The deposit apparently is above the water table at all localities and is not considered to be a water-bearing unit.

The source of recharge to Rice and Vidal Valleys is primarily precipitation that falls on the surrounding mountain ranges. Since the annual precipitation for this desert area is approximately three inches or less, the runoff from the adjacent mountains contributes only a small amount of recharge. Some of the surface runoff is lost due to evaporation, but some percolates into the unconsolidated deposits at the edges of the valley floors and is added to the ground-water basin.

A small amount of ground water may enter Rice Valley as underground inflow from Ward Valley, an adjacent connecting valley.

Twenty-eight wells and springs were inventoried in the Rice and Vidal Valley area. Data for these wells and springs are listed in tables 1 through 3, and their locations are shown on figure 2. Measured water levels by the U.S. Geological Survey in Rice Valley range from 285 feet below land surface in well 3S/21E-18D1 and 181 feet below land surface in well 2S/21E-28N1 to 151 feet below land surface in well 1S/21E-32B1. A small gradient toward the southeast is indicated by these three water-level measurements, and subsurface outflow may occur from Rice Valley through the alluvial drainage divide between the Riverside Mountains and the Big Maria Mountains. Measured water levels in Vidal Valley range from 267 feet below land surface in well 1N/23E-8D1, near Vidal junction, to 246 feet below land surface in well 1N/23E-36R1 at Vidal.

Three wells have been selected as representative to show the range of long-term water-level fluctuations in different parts of the area. Complete records for wells 1S/21E-32B1, 1S/23E-1A2, and 1N/23E-8D1 are shown in table 1.

PREVIOUS WORK AND ACKNOWLEDGMENTS

Data on ground water and geology in Rice and Vidal Valleys are contained in reports by the Geological Survey (Brown, 1920, p. 63-65, and 1923, p. 99-101, 260-261, 280-283; Lee, 1908, p. 18, 65-66; Mendenhall, 1909, p. 79; Thompson, 1929, p. 711-715, 741-747); and the California Department of Public Works (1954, p. 39, 46, 59).

The cooperation given by well owners and other persons who furnished information for this investigation contributed materially to the preparation of this report and is gratefully acknowledged. The California Department of Water Resources, the Riverside County Flood Control District, and the San Bernardino County Flood Control District provided all the pertinent information in their files.

WELL-NUMBERING SYSTEM

The well-numbering system used in the area described in this report has been used by the Geological Survey in California since 1940. It has been adopted by the California Department of Water Resources and by the California Water Pollution Control Board for use throughout the state.

Wells are assigned numbers according to their location in the rectangular system for the subdivision of public land. For example, in the number 1N/23E-8D1 the part of the number preceding the slash (/) indicates the township (T. 1 N.); the number following the slash indicates the range (R. 23 E.); the number following the hyphen (-) indicates the section (sec. 8); the letter following the section number indicates the 40-acre subdivision of the section as shown in the diagram below:

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Within the 40-acre subdivision, the wells are numbered serially as indicated by the final digit. Thus, well 1N/23E-8D1 is the first well to be listed in the $NW\frac{1}{4}NW\frac{1}{4}$ sec. 8. Because the Rice and Vidal area is traversed by the San Bernardino base and meridian, the letters N and S are used to indicate whether the well lies north or south of the base line. The letter E indicates that the entire area is east of the San Bernardino meridian.

For well numbers where a Z has been substituted for the letter designating the 40-acre subdivision, the Z indicates that the well is plotted from unverified location descriptions. The indicated sites of such wells were visited but no evidence of a well could be found.

Springs are numbered according to the same system as wells, except that the letter s has been substituted for the final digit in the number.

REFERENCES CITED

Brown, J. S., 1920, Routes to desert watering places in the Salton Sea region, California: U.S. Geol. Survey Water-Supply Paper 490-A, 86 p., 7 pls., 2 figs.

____________ 1923, The Salton Sea region, California: U.S. Geol. Survey Water-Supply Paper 497, 283 p., 19 pls., 18 figs.

California Department of Public Works, Division of Water Resources, 1954, Ground water occurrence and quality, Colorado River basin region: Water Quality Inv. Rept. no. 4, 59 p., 9 tables, 11 pls.

Lee, W. T., 1908, Geologic reconnaissance of a part of western Arizona: U.S. Geol. Survey Bull. 352, 96 p., 11 pls., 16 figs.

Mendenhall, W. C., 1909, Some desert watering places in southeastern California and southwestern Nevada: U.S. Geol. Survey Water-Supply Paper 224, 98 p., 4 pls.

Thompson, D. G., 1929, The Mohave Desert region, California; a geographic, geologic, and hydrologic reconnaissance: U.S. Geol. Survey Water-Supply Paper 578, 759 p., 34 pls., 20 figs.

Table 1.--Data on water wells and springs in the Rice and Vidal Valley areas, California

USGS number: The number given is the Geological Survey number assigned to the well or spring according to the system described in the text.

Source of data and other numbers: The source of the data and observations on each line is indicated by the following symbols: DWR State of California, Department of Water Resources; GS Geological Survey, or reported by owners, drillers, or others; MWD Metropolitan Water District of Southern California; and WSP U.S. Geological Survey Water-Supply Papers 497 (1923) by J. S. Brown and 578 (1929) by D. G. Thompson; where no symbol is given, the source of data is the same as indicated on the preceding line. Numbers following the letter symbol MWD indicate the number of that well as used by that agency.

Date of observation: Data for each well are presented in reverse chronological order, with the most recent information summarized on the top line, opposite the well number.

Owner or user: The name given is that of the owner or user of the well or spring on the date indicated. In some instances, the local name of the well or spring is given.

Year completed: The year the well was completed was obtained from the driller's log or reported by the owner or others.

Depth: Depths given in feet and tenths were measured below land-surface datum by the Geological Survey; depths given in whole feet were reported by owners, drillers, or others.

Type of well and diameter: The type of well construction is indicated by the following symbols: C cable tool, D dug. The number following the letter is the diameter of the casing or pit in inches.

Pump type and power: The type of pump and(or) method of lift is indicated by the following symbols: L lift, N none, S submersible, T turbine. The type of power is indicated as follows: G gasoline engine, N none; a number in this column indicates electric power and gives the rated horsepower of the motor.

Yield: The yield or output of the pump, in gallons per minute, is usually reported by the well owners or drillers. It is not necessarily the maximum capacity of the well or the installed pump.

Use: Dm domestic, Ds destroyed or dry, and Un unused.

Measuring point: The point from which water-level measurements by the Geological Survey are made is described as follows: Bhc bottom of hole in casing, Hpb hole in pump base, Ls land surface, Na no access, Tap top of access pipe, Tc top of casing, Tcc top of casing cover, Tf top of flange. The suffix letters N, S, E, W, indicate the side--north, south, east, or west--from which the measurement is made. The distance of the measuring point above or below (-) land-surface datum is given in feet and tenths and sometimes hundredths. All measurements of water level are from the same measuring point, unless otherwise indicated; however, not all the measuring points used by others are known.

Altitude: The figure given indicates the altitude, in feet above mean sea level, of the land-surface datum at the well site. This plane of reference is approximately at ground surface. Altitudes were interpolated from Geological Survey topographic maps.

Water level: Measured depths to water level are given in feet, tenths, and sometimes hundredths; reported or approximate depths to water are given in whole feet. The water-level measurements are below land-surface datum. For these measurements, the difference in altitude between land-surface datum and the measuring point has been subtracted from the measured water level.

Other data: C chemical analysis given in table 3; L log of well given in table 2.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (ft.)	Well data: Type	Well data: diameter (in.)	Well data: Pump type	Well data: Pump power	Well data: Yield (gpm)	Well data: Use	Measuring point	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 1 N., R. 20 E.													
1N/20- 1B1	GS	6-19-62			18.1	D	47	N	N		Ds	Tc	2.0	2,400	Dry	
			T. 1 N., R. 21 E.													
1N/21- 5A1	GS	5- 9-62	Turtle Mountain Mining Co. Horn Spring		23.9	D	32	N	N		Un	Tcc	3.0	2,040	11.89	C
5A2	GS	5- 9-62	Turtle Mountain Mining Co.		51.2		6	N	N		Un	Tc	.5	2,040	14.29	
29Ms	GS	5-15-62												1,640	Dry	

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (feet)	Well data: Type	Well data: diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Use	Measuring point	(feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 1 N., R. 23 E.												
1N/23- 5N1	GS	6-18-62	Metropolitan Water District of Southern California (MWD)				16	N N		Ds			960		
5P1	GS	3-28-62	MWD	1933	190.0		8	N N		Ds	Tc	1.0	960	Dry	C,L
	MWD-13	1933			785				100						
8D1	GS	3-28-62	MWD	1933	503.9		16	N N		Un	Tc	5.72	960	267.32	C,L
	MWD-14	9- 5-33			621				90					267	
8D2	GS	6-18-62	MWD		147.1		9	N N		Ds	Tc	1.5	960	Dry	
9E1	GS	3-28-62	State of California	1948	670	C	8	L N	28	Un	Na		930		C,L
9E2	GS	5-16-62	William Claypool	1952	300		6	S 1	11	Dm	Tcc	1.0	930	236	C
	DWR	5-15-57												a237.8	
		10- 1-55												235.0	
		5-25-55												234.9	
		9-16-54												236.5	
		5-11-54												235.3	
36R1	GS	3-28-62	H. Oxnevad		291.0		10	N N		Un	Tc	2.0	640	246.35	
		12-13-61												246.54	

			T. 2 N., R. 23 E.											
2N/23- 7D1	GS	5-13-62	Cascade Gold Mine #1		103.4	D 70	L N		Un	Tc	0	1,720	61.66	C
			T. 3 N., R. 21 E.											
3N/21-28Qs	GS b/	6-22-62	Mopah Spring									2,235		
			T. 1 S., R. 20 E.											
1S/20-14L1	GS	3-29-62	Atchison, Topeka, & Santa Fe Rwy (AT&SF)	1910	575	10	N N		Un	Na		930		C,L
	Owner	1910											450	
14Z1	MWD-12	1933	MWD	1933	657	16			Ds			950	370	C,L
			T. 1 S., R. 21 E.											
1S/21-19G1	GS	3-27-62			293.6	8	N N		Ds	Tc	1.0	880	Dry	
	DWR	9-17-54								Tc	1.0		311.8	
32B1	GS	3-27-62	J. H. Roberts		175	C 16	T G		Un	Hpb	1.5	740	150.65	
32B2	GS	8-24-62	J. H. Roberts		153.6	C 18	N N		Un	Tc	.4	740	152.06	
			T. 1 S., R. 23 E.											
1S/23- 1A1	GS	5- 8-62	AT&SF, well 2	1924	685	16	T 7½	63	Dm	TapE	1.0	627	241.4	C,L
		3-28-62											258.05	
		12-13-61											239.28	
	Owner	1924											230	

See footnotes at end of table.

USGS number	Source of data and other numbers	Date of observation	Owner or user	Well data: Year completed	Well data: Depth (feet)	Well data: Type, diameter (in.)	Well data: Pump type and power	Well data: Yield (gpm)	Well data: Use	Measuring point (feet)	Altitude of lsd (feet)	Water level: Depth below lsd (feet)	Other data
			T. 1 S., R. 23 E.--Continued										
1S/23- 1A2	GS	3-28-62	AT&SF, well 1		348.5	10	N N	55	Un	Tc 2.95	627	241.20	C,L
		12-13-61								Tcc 0		240.77	
	WSP-578				412							250	
			T. 1 S., R. 24 E.										
1S/24- 6E1	GS	3-28-62	Fred Brown	1949	180.1	8	N N		Ds	Tc 0	615	Dry	
6F1	GS	3-28-62			211.2	6			Ds	Tc 0	615	Dry	
			T. 2 S., R. 20 E.										
2S/20- 8B1	GS	3-27-62	Priests Well		143.3	10	N N		Ds	Tc -4.3	985	Dry	C
	WSP-497	10-30-17	Assets Realizing & Mining Co.		587				Dm			507	
11Z1	WSP-578		Grays Well								730	137	
16P1	GS	3-29-62	Browns Well		233.0	D	N N		Ds	Ls 0	890	Dry	C
	WSP-578				304		L G					297	
			T. 2 S., R. 21 E.										
2S/21-28N1	GS	7-21-62	Fred McCoy	1956	500	C 12	N N		Un	Tc .3	750	181.5	C

			T. 3 S., R. 20 E.										
3S/20-13J1	GS WSP-497	3-29-62	Gypsum Well	1914	107.0 585	12 12	N	N G	Ds	BhcW	3.0	910	Dry 125
			T. 3 S., R. 21 E.										
3S/21-18D1	GS	3-29-62				15	N	N	Un	TfE	1.0	885	284.99

a. Well being pumped.
b. Spring not visited.

Table 2.--Drillers' logs of wells

1N/23E-5P1. Metropolitan Water District of Southern California, well 13. Altitude about 960 ft. Drilled by owner in 1933. 8-inch casing, perforated 312-340 and 520-600 ft. Yield 100 gpm.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Gravel ----------------	6	6	Clay -------------	128	366
Clay, cemented --------	8	14	Clay, blue, and "sea shells" ---	36	402
Sand and gravel -------	12	26	Clay, blue -------	118	520
Clay, hard ------------	141	167	Clay, hard, flinty	80	600
Sand, packed ----------	13	180	Shale, hard ------	185	785
Clay, cemented --------	50	230			
Sand, packed ----------	8	238			

1N/23E-8D1. Metropolitan Water District of Southern California, well 14. Altitude about 960 ft. Drilled by owner in 1933. 16-inch casing, perforated 296-366 and 475-603 ft. Yield 90 gpm. Well backfilled to 621 ft.

Topsoil ----------------	4	4	Clay, soft, muddy, and water -------	42	340
Clay, cemented ---------	76	80	Clay, blue --------	101	441
Clay -------------------	37	117	Clay, blue, and shells ----------	55	496
Clay, cemented ---------	25	142	Shale, broken, sand and water --	28	524
Sand, packed, and gravel --------------	18	160	Clay, hard, blue --	34	558
Clay, cemented ---------	26	186	Shale, hard, blue--	45	603
Sand, packed, and gravel --------------	4	190	"Blow sand" -------	1	604
Clay, hard -------------	30	220	Clay --------------	20	624
Sand, packed -----------	10	230	Clay, blue --------	5	629
Clay, soft -------------	58	288			
Clay, hard, flinty -----	10	298			

1N/23E-9E1. State of California, Department of Agriculture. Altitude about 930 ft. Drilled by Rex Roberts in 1947-48. 8-inch casing. Yield 28 gpm.

Gravel -----------------	20	20	Sand, dry ---------	3	425
Sand, packed -----------	113	133	Sand and clay -----	100	525
Clay, yellow, sandy ----	77	210	Clay, blue --------	20	545
Clay, white, sandy -----	42	252	Sandstone ---------	10	555
"Water sand" -----------	8	260	Sand and clay -----	25	580
Clay, white, sandy -----	10	270	Clay, blue, hard --	50	630
Shale, blue, sea shells	10	280	"Water sand" ------	18	648
Sand, dry --------------	108	388	Clay, blue --------	4	652
Shale, blue, sandy -----	6	394	"Water sand" ------	18	670
Sand and shale "breaks"	28	422			

1S/20E-14L1. The Atchison, Topeka, and Santa Fe Railway System. Altitude about 930 ft. Drilled by Arizona and California Railway Co. in 1910. 10-inch screw-pipe casing.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Gravel, coarse, and malapai boulders ---	300	300	Clay ------------	105	540
Sand, fine, loose ----	70	370	Quicksand & water	15	555
Gravel, sand, & water	65	435	Clay & limestone boulders ------	20	575

1S/20E-14Z1. Metropolitan Water District of Southern California, well 12. Altitude about 950 ft. Drilled by owner in 1933. 16-inch casing.

Topsoil --------------	4	4	Sand, gravel, and clay ------	25	451
Clay, cemented -------	18	22	Clay ------------	73	524
Clay, sandy, hard ----	118	140	Clay, blue ------	40	564
Clay, sandy, soft ----	178	318	Clay ------------	78	642
Gravel, packed, & boulders -----------	108	426	Clay, cemented, and sand ------	15	657

1S/23E-1A1. The Atchison, Topeka, and Santa Fe Railway System, well 2. Altitude about 627 ft. Drilled by Roscoe Moss Co. in 1924. 16-inch casing to 614 ft, perforated 245-255, 375-385, 500-505, 595-605 ft. Yield 63 gpm with 50 ft drawdown.

Sand and gravel ------	20	20	Shale -----------	218	600
Sand, gravel, and boulders -----------	63	83	Gravel ----------	5	605
Clay -----------------	117	200	Clay, white -----	5	610
Shale, sandy ---------	25	225	"Cement gravel"	12	622
Shale ----------------	153	378	Granite, decomposed	53	675
"Shell rock" ---------	4	382	Malapi ----------	10	685

1S/23E-1A2. The Atchison, Topeka, and Santa Fe Railway System, well 1. Altitude about 627 ft. Drilled by owner. 10-inch screw-pipe casing to 265 ft, 8-inch to 385 ft, perforated 320-385 ft. Yield 55 gpm.

Sand, loose, and gravel -------------	225	225	Clay, blue -------	20	360
Clay, blue -----------	85	310	Shale, sandy -----	40	400
Sand, loose ----------	30	340	Clay, blue -------	12	412

Table 3.--Chemical analyses of water from wells

The calculated values of dissolved solids were computed from the sum of determined constituents by the Ground Water Branch, U.S. Geological Survey. Values for sodium preceded by the letter a indicate a combination of sodium and potassium. Values preceded by the letter b were calculated by the Ground Water Branch. Values preceded by the letter c indicate a combination of calcium and magnesium.

Analyzing laboratory: AT&SFRy Atchison, Topeka, and Santa Fe Railway; San Bernardino, Calif.; DWR California Department of Water Resources, Los Angeles, Calif.; MWD The Metropolitan Water District of Southern California, Los Angeles, Calif.; SBCFCD San Bernardino County Flood Control District, San Bernardino, Calif.

Well number	1N/21E-5A1	1N/23E-5P1		
Date of collection	5-9-62[3/]	4-19-33	3-28-33	3-26-33
Results in parts per million				
Silica (SiO_2)	28			
Iron (Fe)				
Calcium (Ca)	170			
Magnesium (Mg)	44			
Sodium (Na)	92			
Potassium (K)	10			
Bicarbonate (HCO_3)	265			
Carbonate (CO_3)	0			
Sulfate (SO_4)	147			
Chloride (Cl)	312	139		
Fluoride (F)	.7			
Nitrate (NO_3)	11			
Boron (B)	.20			
Dissolved solids				
Calculated	946			
Residue on evaporation at 180°C	1,090	660	650	612
Hardness as $CaCO_3$	605	74	74	57
Noncarbonate hardness as $CaCO_3$	388			
Percent sodium	25			
Specific conductance (micromhos at 25°C)	1,620			
pH	7.5			
Temperature (°F)	73			
Depth of well (feet)	23.9	190.0	190.0	190.0
Analyzing laboratory	DWR	MWD	MWD	MWD
Laboratory number	R4479			

See footnotes at end of table.

Well number	1N/23E-8D1	1N/23E-9E1	
Date of collection	9-16-33	1-8-51	12-13-50
Results in parts per million			
Silica (SiO_2)			
Iron (Fe)			
Calcium (Ca)		7.0	7.0
Magnesium (Mg)		2.0	2.0
Sodium (Na)		158	158
Potassium (K)			
Bicarbonate (HCO_3)		166	166
Carbonate (CO_3)		0	0
Sulfate (SO_4)		85	85
Chloride (Cl)	148	112	112
Fluoride (F)			
Nitrate (NO_3)		3.5	3.5
Boron (B)		.30	.30
Dissolved solids			
Calculated		450	450
Residue on evaporation at 180°C	610	458	458
Hardness as $CaCO_3$	55	26	
Noncarbonate hardness as $CaCO_3$			
Percent sodium		93	
Specific conductance (micromhos at 25°C)		800	800
pH		8.0	
Temperature (°F)			
Depth of well (feet)	503.9	670	670
Analyzing laboratory	MWD	SBCFCD	DWR
Laboratory number			128

Well number	1N/23E-9E2				
Date of collection	6-6-62	5-15-61	9-15-60	5-17-60	9-10-59
Results in parts per million					
Silica (SiO_2)		15	30		
Iron (Fe)					
Calcium (Ca)		23	21		
Magnesium (Mg)		4.3	10		
Sodium (Na)		190	182		
Potassium (K)		3.4	7.0		
Bicarbonate (HCO_3)	80	83	81	81	79
Carbonate (CO_3)		0	0	0	0
Sulfate (SO_4)	152	171	168		
Chloride (Cl)		158	182	157	154
Fluoride (F)		.9	.9		
Nitrate (NO_3)		17	5		
Boron (B)		.36			
Dissolved solids					
Calculated		624	646		
Residue on evaporation at 180°C		615	620		
Hardness as $CaCO_3$	71	74	95	75	75
Noncarbonate hardness as $CaCO_3$	5	6	28		10
Percent sodium		84	79		
Specific conductance (micromhos at 25°C)		1,040	1,020	1,020	1,050
pH	8.0	7.7	8.2	7.5	8.1
Temperature (°F)					
Depth of well (feet)	300	300	300	300	300
Analyzing laboratory	DWR	DWR	DWR	DWR	DWR
Laboratory number	L2756	12631	L280	11547	R2803

Well number	1N/23E-9E2			
Date of collection	5-17-59	9-5-58	5-9-58	5-15-57
Results in parts per million				
Silica (SiO_2)		20	13	20
Iron (Fe)		0		
Calcium (Ca)		23	26	21
Magnesium (Mg)		4.0	7.0	5.0
Sodium (Na)		190	182	182
Potassium (K)		3.4	3.5	3.1
Bicarbonate (HCO_3)	79	83	95	86
Carbonate (CO_3)	0		0	0
Sulfate (SO_4)		171	189	153
Chloride (Cl)	154	159	143	156
Fluoride (F)		.8	.7	.8
Nitrate (NO_3)		26	13	15
Boron (B)		.24	.90	.32
Dissolved solids				
Calculated		638	625	598
Residue on evaporation at 180°C		625	634	583
Hardness as $CaCO_3$	75	75	95	74
Noncarbonate hardness as $CaCO_3$	10	7		
Percent sodium		84	80	b84
Specific conductance (micromhos at 25°C)	1,040	1,030	1,000	1,030
pH	7.5	7.9	7.8	7.3
Temperature (°F)				
Depth of well (feet)	300	300	300	300
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	R2550	9742	T1844	7871

Well number	1N/23E-9E2				
Date of collection	10-17-56	5-30-56	5-23-55	9-16-54	5-11-54
Results in parts per million					
Silica (SiO_2)					
Iron (Fe)					
Calcium (Ca)				26	28
Magnesium (Mg)				3.0	2.7
Sodium (Na)				191	179
Potassium (K)				3.5	3.2
Bicarbonate (HCO_3)	78	87	137	82	77
Carbonate (CO_3)	0	0	0		0
Sulfate (SO_4)				178	176
Chloride (Cl)	153	154	152	167	149
Fluoride (F)				1.2	.8
Nitrate (NO_3)				16	19
Boron (B)				.65	.35
Dissolved solids					
Calculated				626	596
Residue on evaporation at 180°C				610	574
Hardness as $CaCO_3$	75	77		76	80
Noncarbonate hardness as $CaCO_3$					
Percent sodium				84	82
Specific conductance (micromhos at 25°C)	1,030	1,060	922	1,050	1,020
pH	7.8	8.2	7.9	8.0	8.1
Temperature (°F)				85	86
Depth of well (feet)	300	300	300	300	300
Analyzing laboratory	DWR	DWR	DWR	DWR	DWR
Laboratory number	7386	7033	5767	R388	P523

Well number	2N/23E-7D1	1S/20E-14L1	1S/20E-14Z1
Date of collection	5-13-62[3]	7-2-10[2]	4-26-33
Results in parts per million			
Silica (SiO_2)	27		
Iron (Fe)			
Calcium (Ca)	176	56	
Magnesium (Mg)	62	44	
Sodium (Na)	118	658	
Potassium (K)	3.9		
Bicarbonate (HCO_3)	278		
Carbonate (CO_3)	0		
Sulfate (SO_4)	53	692	
Chloride (Cl)	472	656	769
Fluoride (F)	.5		
Nitrate (NO_3)	8.1		
Boron (B)	.24		
Dissolved solids			
Calculated	1,060		
Residue on evaporation at 180°C	1,320	2,170	2,340
Hardness as $CaCO_3$	695	321	266
Noncarbonate hardness	468		
Percent sodium	27		
Specific conductance (micromhos at 25°C)	1,920		
pH	7.8		
Temperature (°F)	73		
Depth of well (feet)	103.4	575	657
Analyzing laboratory	DWR	AT&SFRy	MWD
Laboratory number	R4478	10807	

See footnotes at end of table.

Well number	1S/23E-1A1				
Date of collection	6-6-62	5-15-61	5-17-60	5-17-59	9-5-58
Results in parts per million					
Silica (SiO_2)	24				
Iron (Fe)					
Calcium (Ca)	14	15			
Magnesium (Mg)	2	0			
Sodium (Na)	207	205			
Potassium (K)	1.5	2.0			
Bicarbonate (HCO_3)	69	56	88	70	80
Carbonate (CO_3)	2	5	0	0	0
Sulfate (SO_4)	134	178			
Chloride (Cl)	164	163	161	163	161
Fluoride (F)	3.4	9.6			
Nitrate (NO_3)	0	.5			
Boron (B)	1.0	1.0			
Dissolved solids					
Calculated	636	607			
Residue on evaporation at 180°C	628	630			
Hardness as $CaCO_3$	43	38	45	43	42
Noncarbonate hardness as $CaCO_3$	0	0			
Percent sodium	91	92			
Specific conductance (micromhos at 25°C)	1,040	1,050	1,060	1,080	1,090
pH	8.3	8.2	8.0	8.0	8.3
Temperature (°F)		93	90		
Depth of well (feet)	685	685	685	685	685
Analyzing laboratory	DWR	DWR	DWR	DWR	DWR
Laboratory number	L2853	12660	R3234	R2549	T2599

Well number	1S/23E-1A1			
Date of collection	5-9-58	5-17-57	10-17-56	5-30-56
Results in parts per million				
Silica (SiO_2)	26		30	
Iron (Fe)				
Calcium (Ca)	14		14	
Magnesium (Mg)	1.0		2.0	
Sodium (Na)	202		200	
Potassium (K)	3.1		2.4	
Bicarbonate (HCO_3)	79	62	68	5
Carbonate (CO_3)	0	0	0	56
Sulfate (SO_4)	175		170	
Chloride (Cl)	175	166	163	163
Fluoride (F)	1.8		9.0	
Nitrate (NO_3)	0		.7	
Boron (B)	.32		.96	
Dissolved solids				
Calculated	637		625	
Residue on evaporation at 180°C	687		648	
Hardness as $CaCO_3$	40	37	40	38
Noncarbonate hardness as $CaCO_3$				
Percent sodium	91		b90	
Specific conductance (micromhos at 25°C)	1,080	962	1,030	1,070
pH	7.7	7.4	7.9	8.5
Temperature (°F)				
Depth of well (feet)	685	685	685	685
Analyzing laboratory	DWR	DWR	DWR	DWR
Laboratory number	T1856	8073	7385	7040

Well number	1S/23E-1A1			
Date of collection	10-1-55	5-24-55	6-13-29[2/]	4-2-27[2/]
Results in parts per million				
Silica (SiO_2)				
Iron (Fe)				
Calcium (Ca)	15	13	244	
Magnesium (Mg)	1.0	3.0		
Sodium (Na)	210	205	372	203
Potassium (K)	2.0	2.0		
Bicarbonate (HCO_3)	54	44		
Carbonate (CO_3)	12	7	33	
Sulfate (SO_4)	174	175	197	207
Chloride (Cl)	164	167	167	160
Fluoride (F)	9.0	9.0		
Nitrate (NO_3)	0	4.5		
Boron (B)	1.2	.98		
Dissolved solids				
Calculated	615	608		
Residue on evaporation at 180°C	634	625	660	622
Hardness as $CaCO_3$	40	45		
Noncarbonate hardness as $CaCO_3$				
Percent sodium	b91	90		
Specific conductance (micromhos at 25°C)	995	960		
pH	8.7	8.7		
Temperature (°F)				
Depth of well (feet)	685	685	685	685
Analyzing laboratory	DWR	DWR	AT&SFRy	AT&SFRy
Laboratory number	6135	5762	29540	25949

See footnotes at end of table.

Well number	1S/23E-1A2	2S/20E-8B1
Date of collection	8-11-10	10-30-17[1]
Results in parts per million		
Silica (SiO_2)		28
Iron (Fe)		1.1
Calcium (Ca)	c22	82
Magnesium (Mg)		29
Sodium (Na)	216	a811
Potassium (K)		
Bicarbonate (HCO_3)	132	95
Carbonate (CO_3)		0
Sulfate (SO_4)	176	766
Chloride (Cl)	164	842
Fluoride (F)		
Nitrate (NO_3)		2.6
Boron (B)		
Dissolved solids		
Calculated	643	2,610
Residue on evaporation at 180°C	642	2,690
Hardness as $CaCO_3$	55	324
Noncarbonate hardness as $CaCO_3$		
Percent sodium		
Specific conductance (micromhos at 25°C)		
pH		
Temperature (°F)		
Depth of well (feet)	343.5	143.3
Analyzing laboratory	AT&SFRy	
Laboratory number		

See footnotes at end of table.

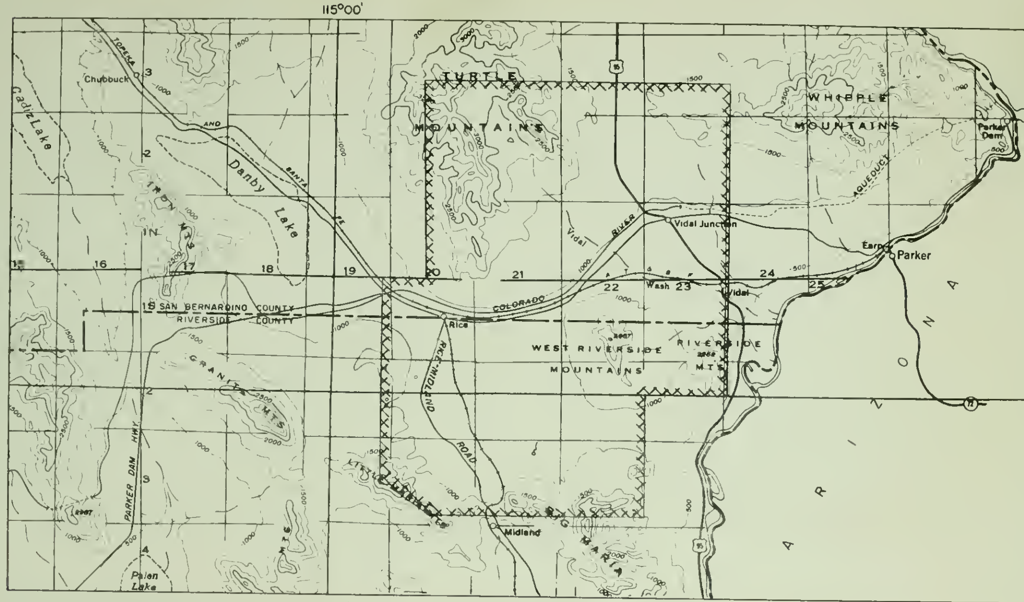
Well number	2S/20E-16P1	2S/21E-28N1
Date of collection	10-30-17[1]	2-3-56
Results in parts per million		
Silica (SiO_2)	25	
Iron (Fe)	.80	
Calcium (Ca)	27	148
Magnesium (Mg)	7.2	37
Sodium (Na)	a191	390
Potassium (K)		5.2
Bicarbonate (HCO_3)	190	63
Carbonate (CO_3)	0	0
Sulfate (SO_4)[3]	246	1,010
Chloride (Cl)	69	194
Fluoride (F)		1.8
Nitrate (NO_3)	2.3	2.0
Boron (B)		2.8
Dissolved solids		
Calculated	662	1,820
Residue on evaporation at 180°C	661	1,890
Hardness as $CaCO_3$	97	522
Noncarbonate hardness as $CaCO_3$		
Percent sodium		62
Specific conductance (micromhos at 25°C)		2,640
pH		7.8
Temperature (°F)		
Depth of well (feet)	233.0	500
Analyzing laboratory		DWR
Laboratory number		6631

1. Analysis from U.S. Geological Survey Water-Supply Paper 497, p. 280-281.
2. Calculated by the Ground Water Branch from hypothetical combinations.
3. Sampled with grab-sampler.

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

FEDERAL–STATE COOPERATIVE GROUND WATER INVESTIGATIONS
1963

U. S. GEOLOGICAL SURVEY



Base map from U S Geological Survey topographic map of State of California, south half, scale 1:500,000

FIGURE I.—Map of part of southern California showing area described by this report

0 10 20 MILES

MAP LOCATION

FIGURE I

EXPLANATION

UNCONSOLIDATED DEPOSITS

QUATERNARY

Recent

Qya

Younger alluvium

Poorly sorted gravel, sand, clay, and silt, unconsolidated, commonly overlies older units as a thin veneer, largely above the water table, if saturated, probably yields water freely to wells

Qp

Playa deposits

Clay, silt and sand, unconsolidated, relatively impermeable, do not yield water readily to wells

Qs

Windblown sand

Sand, unconsolidated, actively drifting, locally anchored by vegetation, apparently above the water table and is not considered a water-bearing unit

Pleistocene

Qoa

Older alluvium

Sand, well sorted, interbedded with gravel, silt and clay, unconsolidated to poorly indurated, where saturated yields water freely to wells

Ql

Lacustrine deposits

Clay, interbedded with well-sorted, very fine sand and silt, moderately indurated, locally dissected, may yield small amounts of water to wells

Qf

Fan deposits

Poorly sorted boulders, gravel, sand, silt, and clay, unconsolidated to moderately indurated, locally dissected, desert pavement locally well-developed, generally above the water table and, therefore, yield little water to wells

CONSOLIDATED ROCKS

TERTIARY(?) AND QUATERNARY(?)

Pliocene(?) and Pleistocene(?)

QTv

Volcanic rocks, undifferentiated

Lava flows, mainly basalt with some felsic volcanic rocks, virtually not water bearing

PRE-TERTIARY

pTu

Basement complex

Metamorphic and igneous intrusive rocks of pre Tertiary age, overlain in places by volcanic rocks of Tertiary(?) and Quaternary(?) age, virtually not water bearing except for minor amounts from cracks and residuum

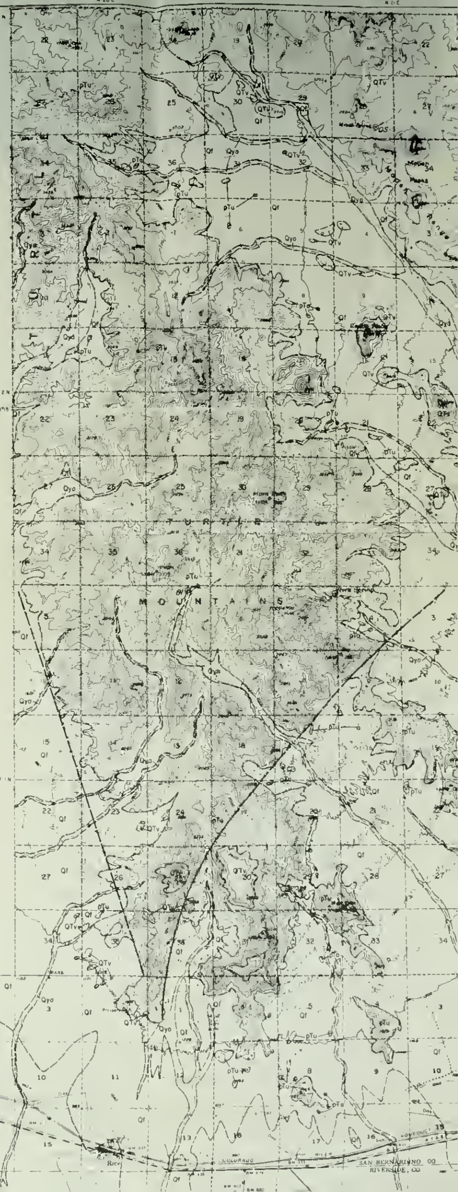
MAP SYMBOLS

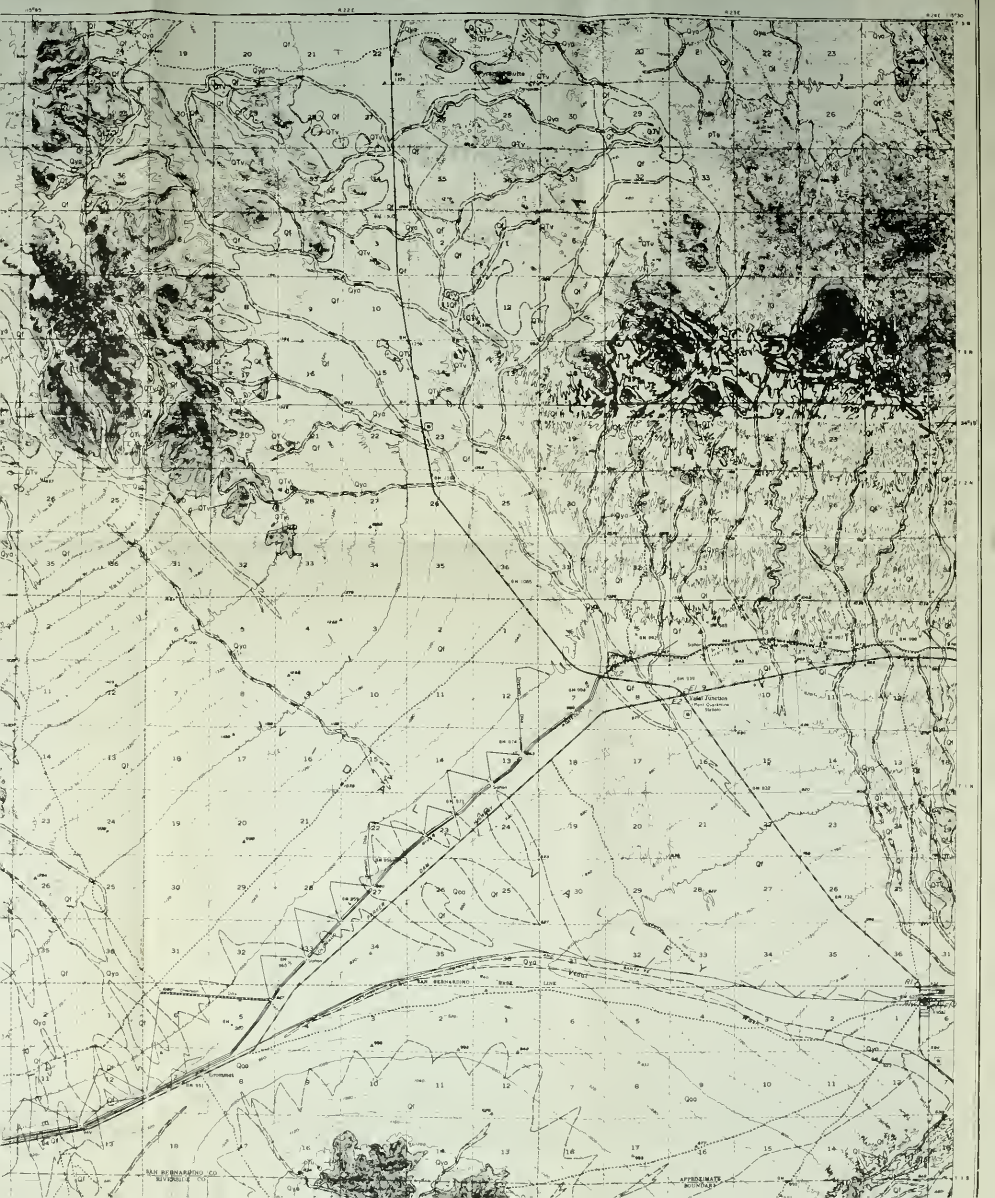
Contact

Dashed where approximately located

Fault

Dashed where approximately located, dotted where concealed




R 22 E
R 23 E
Vidal Junction
V I D A L
V A L L E Y
SAN BERNARDINO BASE LINE
SAN BERNARDINO CO.
RIVERSIDE CO.
APPROXIMATE BOUNDARY
Vidal

Fault
Dashed where approximately located, dotted where concealed

Shoreline with hachure on high side

O_{E1}
Domestic or unused well

$O_{A1,2}$
Well with pump rating of 5 horsepower or more

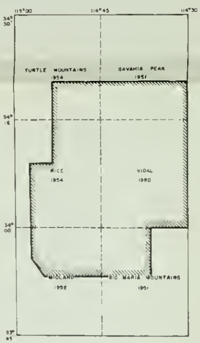
Φ_{B1}
Dry or destroyed well

MS
Spring

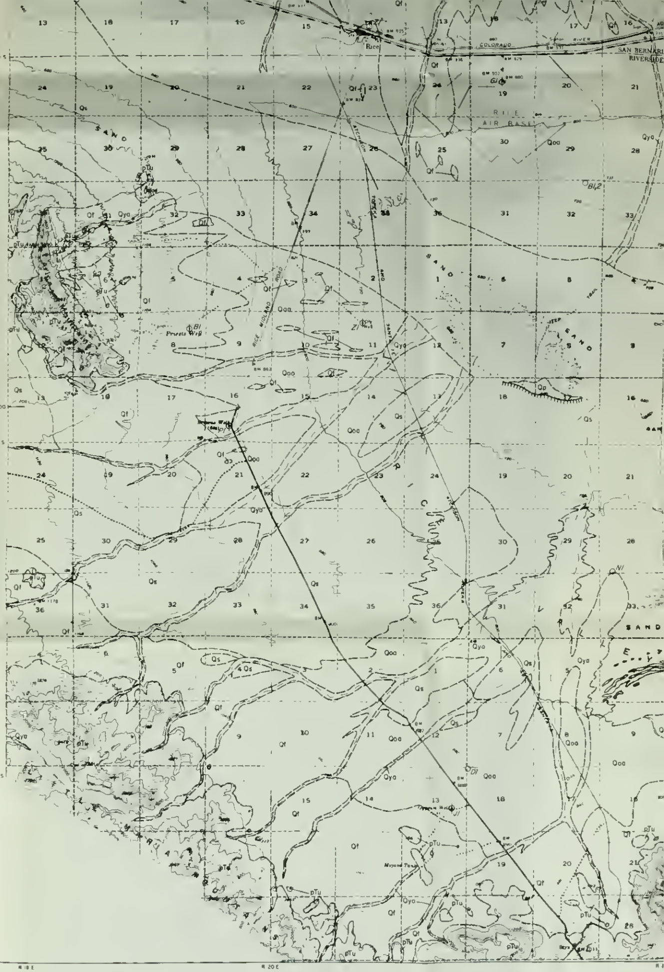
Letter next to well indicates position in section as shown below

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Letter Z indicates the well was plotted from an unverified location description



INDEX TO TOPOGRAPHIC QUADRANGLE MAPS



Base from U S Geological Survey topographic maps, scale 1:62,500, 1962

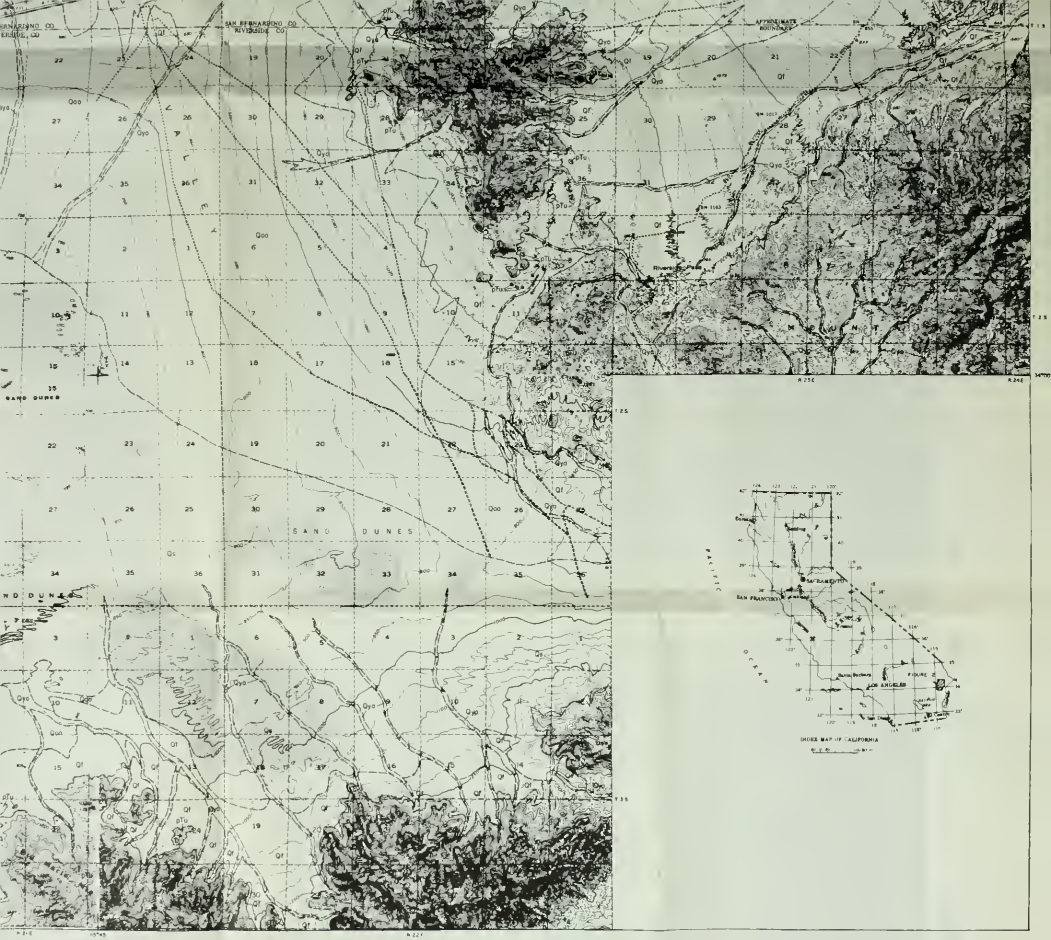
BULLETIN NO. 91-8

MAP OF THE RICE AND VIDAL V

SHOWING RECONNAISSANCE GEOLOGY AND L

SCALE 1:62500

CONTOUR INTERVALS 40, 50



Geology and location of wells by
F W Giessner, 1962

VALLEY AREAS, CALIFORNIA
D LOCATION OF WELLS AND SPRINGS

1:62500

40, 50, AND 80 FEET

APPROXIMATE MEAN DECLINATION 1962

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

FEDERAL-STATE COOPERATIVE
GROUND WATER INVESTIGATIONS

PREPARED BY U.S GEOLOGICAL SURVEY
1963